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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN
Editor

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"Engineering News-Record" is a consolidation of "Engineering News" and "Engineering Record," effected in 1917.

"Engineering News" was founded in 1874 by George H. Frost, as the "Engineer and Surveyor," which title subsequently became the "Engineer, Architect and Surveyor," then "Engineering News and American Railway Journal" and finally, "Engineering News," under the successive editorships of D. McN. Stauffer, Arthur M. Wellington and Charles Whiting Baker.

"Engineering Record" was established in 1877 by Henry C. Meyer as the "Plumber and Sanitary Engineer." The name was subsequently changed to the "Sanitary Engineer," "Engineering and Building Record" and, finally, to "Engineering Record." During his ownership of the paper, Mr. Meyer was directly responsible for the editorial policy. John M. Goodell became editor in 1902, and was succeeded by E. J. Mehren.

The staff of "Engineering News-Record" consists of

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New School of Cost Estimating

LIKE the recent articles on estimating plant rental, on concrete road costs and on the cost of construction trestles (*Engineering News-Record*, Jan. 15, p. 125; Feb. 5, p. 261; and April 29, 1920, p. 844), the article by G. C. D. Lenth on p. 22, containing diagrams for computing sewer costs, is a product of the new school of estimating contract prices. Incidentally the new practice has its origin in conditions created by the war. It is more truly, however, a reflection of the advent of the engineer-manager into contracting. Scientific appraisal is being substituted for the ancient art of predicting costs from data secured by past experience. In sewer construction the time is not far past when current bidding prices, carefully analyzed, gave a fairly reliable basis on which to estimate new work. In those days also the engineer or contractor who had a comprehensive tabulation of classified unit costs considered himself as perfectly equipped to build up a cost estimate. Post-war conditions have overturned these old bases. Bidding prices and unit costs are as mercurial as the temperament of a prima donna. A construction workman establishes his pay and his output in a spirit of independence which even a queen of the opera must despair of achieving. What has been, in costs, is no assurance of what will be. A cost predicting basis more reliable than those which sufficed in the past is being sought in the articles to which reference has been made.

New Facts on Stored Cement

THAT caked cement is low in strength has been known for a long time. As far back as 1906 *Engineering News* published a symposium of tests which show marked reductions in strength of cements which contained obvious cakes, even though these cakes were reduced to powder before mixing. But that stored cement in which the pulverization is complete loses its strength in proportion to the length of its storage has not been generally appreciated. The tests by Professor Abrams, noted last week on p. 1263, are therefore of great importance. The seriousness of the situation is lessened by the facts that the losses are in early strength and that design stresses are based on tests from cement of about the usual period of storage for construction work. The studies show, however, how wide a range of possible values must be taken care of in factors of safety and indicate, too, some additional reasons why test results vary so widely. The practical application is not so evident, except perhaps that long storage is undesirable and bulk storage more worth looking into than ever before. Some storage is necessary for seasoning purposes. Just where the benefits of seasoning stop and the dangers of strength loss begin is not well defined.

A Water-Works Standardization Council

AT FIRST thought, the Water-Works Standardization Council, provided for at the Montreal convention of the American Water Works Association last week, seems over-ambitious. The resolution creating the council is broad enough to enable the council, if a resolution alone were sufficient, to set up standards for not only the character of potable and industrial water-supplies, purification plant design, operation and records, but also for all the materials and supplies entering into water-works construction and operation. To undertake so much would be as impracticable as unnecessary. Other associations have done or are doing much of this work. Duplication would be most unfortunate. However, the resolution originally introduced provided for co-operation with other associations and was so broadened by amendment as to provide that before undertaking any particular line of work there should be consultation with the Engineering Standards Committee. Moreover, in supporting the resolution a member urged that educational work as well as research is needed. There is reason to hope that the council will do as much or more in the way of bringing worthy standards already adopted by other associations before its own organization for adoption as in setting up standards of its own. It seems to be felt that the American Water Works Association needs a new rallying point for committee work. It is to be hoped that the Standardization Council will be an abundant means to that end.

A Spur for Committee Work

NOW to get committee members to do committee work is a problem in many engineering societies as well as in technical and civic associations. Membership conditional upon service rendered is the solution adopted by at least two organizations. Appointment to a committee is accepted frequently as a courtesy involving no responsibility. The chairman is likely to be more conscientious and to prepare some kind of report, which the members may sign offhand or authorize the chairman to sign for them. Thus the report may represent the work and views of one man, while the list of names appended appears to give it the weight of many. The Railway Accounting Officers' Association has adopted a rule that any member of a committee (except the executive committee) who fails to attend three consecutive meetings shall forfeit his membership on that committee. The traffic committee of the Kansas City Engineers' Club has a similar rule in regard to its monthly meetings. It may be objected that this is only negative action, as it provides for penalizing members who do not work. In practice, however, it seems likely to have a positive effect. In the first place the rule serves to remind the member of his duties. In the second place he is likely to be spurred by the knowledge that neglect will result in his losing the prestige of committee membership and that there may be announcement or publication of the fact, which he would desire to avoid.

License Laws Begin to Restrict

WHERE is the licensing problem leading us? Consulting engineers are beginning to find the registration and license law requirements for engineers burdensome. Eleven states regulate the practice of engineering, but New York alone follows closely the model law of Engineering Council's committee on licensing of engineers. The principal difficulty seems to be over the reciprocity features and arises during the early period when the "grandfather" clause is in operation. Other states having taken in their own quota of "grandfathers" object to legalizing those of adjoining states who are slower in obtaining legislation. Illinois has had a structural engineer's license law in effect since 1915. Its own engineers can get a license by one means only, examination, and its attorney general has ruled that no one from outside can get a license in any other way unless he has passed an examination in some other state having equal requirements.

Few, if any, other states have "equal requirements." Efforts are being made to have this ruling in Illinois changed, with reference to what constitutes an examination. It is hoped that evidence of technical qualifications, submitted under oath with the application, will be accepted in lieu of all or a portion of a written or oral test. While there have not been many outside engineers seeking to practice in Illinois, a large number of consultants having offices in Chicago are doing work in surrounding states. To spend three days at an examination, plus the expense, entails no small hardship. As an example, a Chicago engineer desiring to serve clients in Michigan has no other alternative than to go to Lansing and pass an examination. In the article on p. 38 stress is laid on the clause relative to the *submission of evidence satisfactory to the board* as being one of the best ways for an examining board to determine the fitness of an applicant. If this evidence is not sought further proof, which might include the results of an examination, may be submitted.

Mr. Condron, who is chairman of Engineering Council's committee, explained the general situation, June 21, to a joint session of the Western Society of Engineers and the Illinois Structural Engineers' Society, at which he pleaded for a uniform law. As he stated, "it seems to make very little difference whether individual engineers are in favor of license legislation or not. Eleven states already have enacted such laws, and it is now important that the engineering profession unite in demanding uniformity of legislation and the elimination of unnecessary burdensome requirements."

It is decidedly against public policy to bar experienced engineers from practising in as wide a field as possible. Closed-shop methods should operate against the incompetent only, but since restrictions always restrict, there is no other way for the competent man to do than to abide by the rules. That is the price that must be paid to obtain a profession worthy the name. During the transition period the price will be higher than later. If engineers act as a unit the period will be shortened. If they are able to get action from the National Conference of Commissioners on Uniform State Laws, before which Engineering Council has laid the problem, one more progressive step will be taken. Organized engineers in every state should lose no time in bringing forth the model law before some other bill is prepared and receives support.

A Forecast of New Activity

LOOKING into the future and weighing its possibilities by present needs, J. A. Capp, the retiring president of the American Society for Testing Materials, forecasts for that body a new field of work, rich in promise. In his presidential address last week, he declared that there are demands which the society is not now satisfying—demands for increased knowledge of the properties of materials and test methods for measuring these properties. By entering into intensive study of materials and tests, with a strength of purpose equal to that exhibited in the drafting of specifications, the society can do important service to industry and technology. The significance of Mr. Capp's proposal lies in the fact that it touches the lifesprings of the society's vigor.

In taking up the suggested new work the society will in a sense turn back a generation, to the days of its origin. At that time, if our memory serves us, two aims competed for control of the society's activities: the standardizing of specifications, and the study of tests and properties of materials. Under the conditions of that time the choice could not remain in doubt. What industry and engineering—producer and consumer—most urgently needed was a supervisory agency to regulate the delivery and acceptance of material at the point of interchange between the two parties, by means of standardized specifications and test methods, limited to expressing average commercial practice. Accordingly the first of the two stated aims was chosen. The functions which the society could perform in this field were so important that they have been the dominant motives of its work for twenty years, and at no time has there been a suggestion of a change in this respect. But now Mr. Capp draws

the balance sheet, and while he finds ample credits on the side of specifications there is a grave shortage on the side of knowledge of materials. It is time to cultivate the neglected work.

This impulse toward a new kind of productive activity by one of the strongest of American technical societies is to be welcomed. The proposed work will be certain to increase the society's strength. This is said without undervaluing specification-making, an activity both important and difficult; it brings into play abilities of high order, among them a well-balanced judicial temper of arbitrating between production possibilities and users' demands, and a sure appraisal of economic values, but on the other hand it gives little scope for originality. Creative thought might easily atrophy without other opportunity to exercise its powers. Research in materials and study of testing instruments and methods, however, are truly scientific pursuits, in which observation of fact and originality of thought are brought to highest development. Can a society, however strong, fail to gain through the stimulative reaction of such activity?

In the work of standardizing specifications as now conducted, commercial practice is the governing consideration. The objective of the committees engaged in drafting the various specifications is to summarize existing practice in definite form. This applies to test methods as well as to materials. In consequence there is sometimes an obvious failure to realize progress by improving upon established practice. Mr. Capp himself refers to this conservatism of procedure, in more or less veiled terms. It is not far from the truth to say that in some fields of work the society has virtually reached a limit, a stopping point, through restricting itself to following practice rather than leading it.

Beyond doubt research in materials and tests would exert a marked influence upon the attitude toward specification-making. If Mr. Capp's suggestions are adopted, a broader spirit within the society, born of the opportunity to engage in broader work, will pervade its work. Thus the new activity promises to open the door to increased service in the field of specifying and testing for acceptance as surely as it will increase our knowledge of materials.

Factory-Made Roads

A DECIDED innovation in concrete-road construction, noted in *Engineering News-Record*, May 6, p. 890, is the experiment to be undertaken this season in Wyoming of building a road of precast reinforced-concrete slabs made at a stationary plant convenient to the site of the material rather than to mold the slab in place with aggregate hauled 40 miles and water piped 20 miles. The proposed road is 34 miles long and runs north from Casper, Wyo., to the Salt Creek oil fields. The proposal by the State highway engineers to construct an experimental stretch one mile long in this manner has been approved by the U. S. Bureau of Roads.

As the work is now planned, the slabs will be laid on a sand cushion in two sections, each 9 ft. wide. Each slab is to be 9 ft. long with the joints at a small angle with the transverse. The slabs are to be hauled to place by motor trucks and trailers, thus requiring a minimum of labor on the job. Though few details are given, the scheme recalls one proposed in an editorial in *Engineering Record*, April 18, 1914, p. 434. The principal idea there advanced was to use precast slabs on narrow congested city streets where the width between car tracks and curb did not exceed 12 ft., and where there was repeated tearing up of the pavements by public utilities to get at their conduits and service lines. It was recommended also that both sides of the slab should be surfaced so that two wearing surfaces would be available. As noted on p. 20, small slabs have been used with success in repair work in California for several years.

Undoubtedly one of the greatest tasks in the Wyoming work will be to obtain a uniformly smooth subgrade so as to get even joints, but with the present subgrading machines, which can trim to within a fraction of an inch of a predetermined grade, there should be little difficulty in making a smooth foundation. If the slabs were laid on a sand cushion perhaps the double templet used in laying a monolithic brick pavement might spread a thin even sand top similar to the dry cement top on which the brick are placed. A. N. Johnson, chief engineer, Portland Cement Association, suggests trimming out a small portion of the sand from the area under the central protion of the slab so as to insure bedding around the edges. Possibly cast-in-place or precast sills well bedded might be found advantageous, these being placed longitudinally or under the joints. Assumption in the calculations for bridging over hard spots or depressions would at once become definite if sills were used. Making the slabs reversible, as suggested in the *Engineering Record* editorial, might not be worth while in Wyoming where temperature probably will be the greatest disintegrating factor.

The procedure of placing the slabs will require the development of special crews, but they need be no more skilled than are steel bridge erectors. A locomotive crane mounted on caterpillar tractors and operating from the road already laid would be practically all the new equipment required. However, for the Wyoming work a simple gantry crane is proposed. Motor trucks with trailers carrying the slabs would run over the contemplated road at normal city speed, losing little time loading and unloading. The slab factory would of course require no equipment not familiar to engineers who have been using for a decade concrete lumber, blocks and precast floor slabs for railroad bridges.

While the presrent monolithic method will always be standard for the major portion of road work, there will continually arise special cases, of which the Wyoming case is an example, where another method may work out to advantage. First cost is not always the criterion. Time which a heavily traveled road not easily detoured can be kept out of service may justify much extra expense. Should the precast slab method be attempted in the Middle West the factory probably would be located adjacent to a stone crushing plant or gravel pit so that the rail and truck transportation would handle finished product only. The method would eliminate much of the unskilled labor which sometimes is all that can be had in out-of-town localities where transient housing is difficult to obtain. Night-and-day, rain-or-shine, winter-or-summer operations could be carried on almost continuously by the precast method. Valleys in the progress chart would come from something else than summer showers.

Motor Vehicle Instead of Gasoline Tax Probable in Great Britain

Special Conditions Incident to Need for £7,000,000 for Road Work Lead Committee of Thirteen to Recommend Temporary Change in Taxation Clauses for New Budget

By E. J. Mehren
Editor of *Engineering News-Record*

At the last annual meeting of the American Association of State Highway Officials, at Louisville, Ky., three of the states reported that they had laws taxing gasoline used in motor-propelled vehicles. These laws are the culmination of a growing sentiment in favor of some form of tax that would assess motor vehicles in proportion to the extent of the service they demand from the road. The theory has been generally accepted as sound and its advocates have cited Great Britain as an example of its success.

On this account it is interesting to know that the United Kingdom will probably abandon the gasoline tax—the "motor-spirit" or "petrol" tax, as it is called here—temporarily at least, and will substitute a vehicle tax instead. This does not mean that they have changed their minds as to the soundness of a motor-fuel tax. The proposed change is due to conditions of the moment. Nevertheless, the fact that the tax will be abandoned, even temporarily, is worthy of the careful consideration of those in America who are proposing that we should adopt a similar measure. The proposed change is provided in the budget already introduced in Parliament. It is generally conceded that the measure will pass, though the motor-manufacturing and motor-using interests will attempt to secure some abatement of the high taxes proposed.

At present there are motor-vehicle license fees in Great Britain higher than our license fees, but less than our total vehicle taxes if we remember that motor vehicles are subject in the United States to personal-property taxes. The motor-spirit tax is, of course, in addition to these existing vehicle taxes and amount to 6d. (about 12 cents) per imperial gallon, this tax being levied as an import duty on foreign-produced gasoline or motor spirit. Motor spirit used in vehicles employed for industrial purposes is subject to certain rebates, reducing the tax in such cases.

Need £7,000,000 For Highways

The present task of the Government is to raise, independently of the ordinary revenues, £7,000,000 net, these moneys to be used in the inauguration of a new policy of Government aid for *highway maintenance as well as construction.* Until now grants from the Government to local road authorities have not been on a fixed basis, but have been dependent upon the Road Board's view of conditions. Now it is proposed to classify roads in accordance with the extent to which they carry through and local traffic. Those carrying a large proportion of through traffic would be termed first-class roads; those carrying less through traffic, second class roads; while those carrying only local traffic would have some other suitable designation. If the revenues are sufficient, under the proposed plan the Imperial Government hopes to bear annually 50 per cent of the cost of maintaining first-class roads, and 25 per cent of the cost of maintaining second-class roads. In addition, the Imperial Government desires to have available about £1,250,000 annually for road-improvement purposes.

The Chancellor of the Exchequer definitely stated that the Government would not be able from its ordinary sources of revenue to supply the funds needed for this new road program. The vehicle and petrol taxes together now produce about £3,000,000 annually. The additional revenues to be raised, therefore, amount to about £4,000,000.

Committee's Report

That the Government might have the benefit of the widest experience in formulating the new taxes, the Roads Department of the Ministry of Transport appointed a committee of thirteen, composed of representatives of the Ministry, of the Royal Automobile Club, local authorities, the treasury, and of motor manufacturers and users. This committee reported at the end of March and upon their report the taxation clauses in the budget were drawn up.

The report makes it plain that a majority of the members still believe that the motor-spirit tax is the most equitable means of assessing against motor vehicles the charge that they should properly bear for the facilities afforded them by the road. They have agreed to a report recommending the abolition of this tax because of the special conditions of the moment, and recommend that when these conditions have passed, the resurrection of the motor-spirit tax be considered again.

The principal objections to the motor spirit tax, the committee finds, are these:

1. Difficulty of collection, occasioned by the system of rebates.
2. Failure to cover all liquid fuels for mechanical traction.
3. Application to imported fuel only.

These objections, the committee believes, could be remedied by the withdrawal of rebates, by the imposition of special license duties upon those forms of mechanical traction not dependent upon petrol, and by the reimposition of an excise duty on home-produced fuel. The most serious of the difficulties apparently is due to the introduction of so many substitute fuels, home-produced.

More important, however, than these reasons was the objection made by the Chancellor of the Exchequer to an import duty. Being the fiscal officer of the Government, his view necessarily had great weight, and was the determining factor in the committee's decision.

The committee recommended that all motor-spirit duties be done away with and that the revenue be raised solely by vehicle taxes. Motor cycles are given an arbitrary rating; passenger cars are to be assessed £1 per unit of horse power; motor buses on seating capacity, ranging from £15 for five-seated vehicles to

£84 for those seating more than 32, while motor trucks, tractors, and road locomotives would be assessed as follows:

Motor Trucks

	£
Not exceeding 12 cwt. unladen weight	10
Exceeding 12 cwt. but not exceeding 1 ton unladen weight	16
Exceeding 1 ton, but not exceeding 2 tons unladen weight	21
Exceeding 2 tons, but not exceeding 3 tons unladen weight	25
Exceeding 3 tons, but not exceeding 4 tons unladen weight	28
Over 4 tons unladen weight	30
Any of the foregoing with the right to draw trailer	2 (additional)

NOTES:

(1) In ascertaining the unladen weight of electrically propelled vehicles, the weight of the accumulators is to be excluded.

(2) Quarterly licenses to be permitted on payment of 20 per cent above one-fourth of the annual duty.

Other Commercial and Agricultural Vehicles

	£
*Motor Tractors (classed as heavy motor cars)	21
*†Road Locomotives and Agricultural Engines:	
Not exceeding 8 tons unladen weight	25
Exceeding 8 tons, but not exceeding 12 tons unladen weight	28
Exceeding 12 tons unladen weight	30
*†Agricultural Tractors used on roads for haulage solely in connection with agriculture:	
Exceeding 2½ tons, but not exceeding 5 tons unladen weight	6
Exceeding 5 tons	10

A "Tractor" means a mechanically or electrically propelled engine which draws but does not itself carry any load except such as is necessary for its propulsion and equipment.

Quarterly licenses to be permitted on payment of 20 per cent, above one-fourth of the annual duty, except in respect of vehicles only liable to duty at 5s.

These taxes will make the American user of automobiles and motor trucks gasp. That has been their effect also in Great Britain, and efforts to secure the modifications of the proposals, as before noted, are under way. In connection with motor trucks, the committee points out that the owners can pass the heavier taxes to the shipper, but for privately owned passenger cars, the committee works out in detail the difference between the new taxes and the old. This calculation shows that if both the present vehicle and petrol taxes are considered practically, all cars which are run 10,0000 mi. or more per annum will carry a lower tax under the new scale. If run only 5,000 mi. per annum, the 22-hp. car will be taxed about $30 a year more than before. The 35-hp. car will pay $65 a year more, while the 60-hp. car will pay $120 per year more. For runs of only 2,500 mi. per year the excess of the proposed over the present taxes is very much greater, amounting for the 35-hp. car to about $90 per annum.

While these are high taxes compared with those that we have in the United States, the Imperial Government will offer to its motor users a highway system so far superior to our own that comparison between them is ridiculous. I have had the privilege during the last month of riding over many miles of highway in both England and Scotland, and nowhere in the United States, except in small areas here and there, have I found such excellent roads. Not only are the main highways in first-class condition, but the subsidiary roads would put ours to shame. This is the condition to day. Under the policy that will be inaugurated with the raising of the new revenues, it will probably be impossible to find on the first and second-class roads of Great Britain any highway that cannot be honestly classed as "excellent."

*Inclusive of the legally permitted trailers.

†Locomotive ploughing engines, agricultural tractors not exceeding 5 tons unladen weight, or other agricultural engines, drawing necessary gear, threshing appliances, farming implements or supplies of fuel or water, shall pay a duty of 5s. per annum only, if not used on roads for other haulage work.

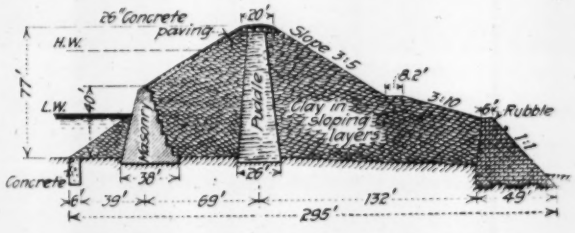
THE COMMITTEE'S ATTITUDE

I cannot close this statement on the proposed taxation of motor vehicles in Great Britain, without reporting the fact that the Committee of the Ministry of Transport did not acquiesce in the principle that might be inferred from its report—that all Imperial grants for road work should be paid out of revenues raised by assessment upon vehicles or on the fuel of self-propelled vehicles. The committee specifically states that many of its members think "that having regard to the importance of cheap transport facilities to the prosperous economic life of the people, it is unsound in principle to place any special tax upon transport agencies which in the nature of things must largely be passed forward in higher rates of fare or charge." The report says, further, that when the present financial situation changes there should be a reconsideration looking to an equitable adjustment of the increased cost of improving and maintaining roads between: (1) the local taxpayers; (2) the Imperial Exchequer; and, (3) the users of the roads.

Edinburgh, May 26.

Combination Earth and Masonry Dam

An earth filled dam with masonry marginal retaining walls has been built in the Enza Valley near Parma, Italy, for an Italian hydro-electric project. The dam, as shown in the accompanying cross-section, has a number of points of novelty to the American engineer. It is 560 ft. long on top, has an extreme bottom width of 295 ft., and a height of 77 ft., the maximum depth of pond behind it being 69 ft. According to an article in the *Annales des Ponts et Chaussees*, Vol. 1, 1920, local conditions did not permit of the construction of a masonry dam, but there was a quantity of excellent clay nearby so an earth dam was decided upon. However, the masonry marginal retaining walls were used for an additional precaution. The upstream face above the wall is paved with hand placed stone and a 26-in. layer of concrete. The main section of the dam is laid in thin clay layers inclined, as shown in the sketch, upward from the center puddle wall. The dam is known as the Paquli de Lagastrello dam.



PAQULI DE LAGASTRELLO DAM IN ITALY

Convention of American Water Works Association

Standardization Council Created—Controversy Over Secretaryship Results in Failure of Proposed Constitutional Amendment—Presidential Address and Abstracts of Papers

MONTREAL being the meeting place for the fortieth annual convention of the American Water Works Association, held June 21-25, it was fitting to give ample and prominent place on the program to Canadian waterworks, which were described in papers by Thomas W. Lesage, F. H. Pitcher, J. O. Meadows, C. P. Cosgrove, T. J. Lafreniere. Two detailed papers on the design and the construction of the new water-supply of Winnipeg, with its 97-mile reinforced-concrete aqueduct, were presented in abstract by James H. Fuertes, consulting engineer, New York City, and W. G. Chace, chief engineer.

Individual water-works plants south of the Canadian line were also a feature of the program. A five-year campaign to effect pumping station economies at St. Louis, described by Leonard A. Day, was one of the most valuable papers on the program. Construction difficulties overcome in building a new pumping station for Louisville were described by James B. Wilson. A rich variety of experiences in water-works operation at Rochester, N. Y., was laid before the convention by Beekman C. Little, the association's new president. More general papers of large import were submitted by George W. Fuller and Leonard Metcalf, who dealt with "Cost Plus Contracts" and "War Burdens of Water-Works," respectively.

The superintendents again had their "day"—now a feature at each convention—and the chemical and bacteriological section had a long session on "Quality of Water" with no less than seven numbers on the program.

Committee reports were for the most part of either the routine or "progress" type. Among the important actions taken by the convention were the creation of a Standardization Council, a committee on standardization of brass fittings, and a committee on proper sizes of meters for multi-family houses.

Ample entertainment was provided by the Water Works Manufacturers' Association, including a boat trip down the Lachine Rapids. An extensive exhibit was also due to the efforts of the associate members.

Amendments to Constitution—Of two proposed amendments to the constitution one was adopted and one defeated by the convention. The one adopted permits the nominating committee to meet and select candidates before the convention adjourns instead of having to come together subsequently, at an expense of $500 to the association. Opportunity for nomination by petition prior to sending out the letter ballot is retained.

Controversy Over Secretaryship

The defeated amendment was designed to take the selection of the secretary away from the Executive Committee and make it an elective office. This amendment was proposed by a petition signed by eight members; the Executive Committee advised its rejection. The amendment was defeated by a vote of 53 to 5. On reconsideration the motion was laid on the table and it was voted as the sense of those present that the incoming Executive Committee should re-elect John M. Diven secretary for another year.

The discussion brought out statements to the effect that there had been lack of co-operation between Secretary Diven and the Executive Committee, and also between Mr. Diven and John M. Goodell, editor of the *Journal*. A plan to make Mr. Diven honorary paid secretary, with the special duty of maintaining relations with the superintendent-members, and to make Mr. Goodell both active secretary and editor, did not appear to suit Mr. Diven or his supporters.

Before the convention adjourned the new Executive Committee reappointed Mr. Diven as secretary and Mr. Goodell as editor.

Finances—Notwithstanding heavy increased costs the association showed a balance of only $127 less than last year, according to the report of the Finance Committee, George A. Johnson chairman. The expenses for the year were about $13,800. The balance is $2,000 and there is $12,000 in the permanent investment fund. To meet a proposed budget increase designed to expand the work of the association, the Finance Committee recommended increases in dues as follows: Corporate members, from $5 to $10; associate members, $10 to $15; active, $5 to $6. The convention voted to send to letter ballot a proposal to raise the dues as just stated, except that the dues for active members would be $7, and that the increase would be retroactive for one year.

Next Meeting Place—Cleveland was tentatively chosen as the place for the next convention, subject to final approval by the Convention Committee.

New Officers

With the single exception of the treasurer, the 1920-21 ticket proposed by the nominating committee was elected. The vote stood: President, Beekman C. Little, Rochester, N. Y., 467; Capt. M. L. Worrell, Camp Dix, N. J., 314. Vice-president, Edward Bartow, Urbana, Ill., 448; W. S. Cramer, Lexington, Ky., 320. Treasurer, James M. Caird (re-elected), Troy, N. Y., 416; J. W. Ackerman, Watertown, N. Y., 351. Trustees (two to be chosen, no contest), Harry F. Huy, Buffalo, N. Y., 575, and Robert J. Harding, San Antonio, Tex., 557.

New Nominating Committee and Its Nominees—The six geographical districts, through such of their representatives at the convention as got together for the purpose, chose the following nominating committee: (1) T. J. Lafreniere, Quebec, P. Q.; (2) George C. Andrews, Buffalo, N. Y.; (3) Herman Rosenstreter, Newark, N. J., (4) H. E. Keeler, Chicago; (5) E. L. Fulkerson, Waco, Tex., (6) Thomas Maloney, Council Bluffs, Iowa. Acting with these was the latest past-president attending the convention, Theodore Leisen, Detroit. The committee submitted the following ticket for 1921-22: President, Edward Bartow, Urbana, Ill.; vice-president, W. S. Cramer, Lexington, Ky.; treasurer, W. W. Brush, New York City. Trustees, third district, George C. Gensheimer, Erie, Pa.; sixth district, J. Chris. Jensen, Council Bluffs, Iowa.

The committee on official standards of water analysis, through Jask Hinman, Jr., chairman, Iowa City, Iowa, reported that in the light of present knowledge "the difficulties in the way of a fully successful general standard, based upon the results of analyses alone, seem to your committee to be insurmountable."

On motion of George A. Johnson, it was voted to create a Council on Standardization, to consist of five members appointed by the president, the council to have authority to establish sub-committees composed as it sees fit. The original resolution was amended, on motion of John H. Gregory, so as to instruct the council to confer with the Engineering Standards Committee before adopting a program. The council will also have power to co-operate with other organizations. According to Mr. Johnson's resolution, the council is expected to enter upon a wide range of standardization work, including methods of water analysis, design, operation and records of water purification plants; standards of water purity; and water-works materials and supplies of various sorts.

Electrolysis Committee—The association's representatives on the American Electrolysis Committee reported through Edward E. Minor, New Haven, that the Bureau of Standards agreed for a year to concentrate its electrolysis studies on work in co-operation with the research sub-committee of the American Electrolysis Committee. Studies along eight or nine lines are being made. The convention referred to the Executive Committee the question of further co-operation with the American Electrolysis Committee. Later, the Executive Committee endorsed and the convention approved a recommendation in the report to the effect that transformer secondaries be grounded to water pipes, in accordance with standard rules.

Superintendents' Day—Superintendents' Day met its usual fate. A promising program, with a number of good topics and chosen speakers, started off well and then collapsed. The controversy over the election of the secretary arose and topics not on the program were introduced. The combined result was the elimination of what promised to be useful discussion on several practical subjects.

Meters for Multiple-Family Houses

Short papers introducing this subject were presented by H. P. Bohmann, Milwaukee; G. A. Elliott, San Francisco; D. W. French, Hoboken, N. J., and W. R. Edwards, Paterson. Mr. Bohmann said that under a rule in force many years, the city of Milwaukee requires that all meters must be the same size as the corporation cock. The city permits consumers to set nothing smaller than ⅝-in. meters and the city itself sets none less than ¾ in. Mr. Elliott stated that the Spring Valley Water Co., which has been metering domestic consumers only a short time, uses ⅝-in. meters for houses with one to six families and ¾-in. for seven to ten families, and so on. Studies show no close connection between the number of families and the total water consumption in a given house. With a pressure of 40 lb., Mr. Elliott thought, it would be safe to use ⅝-in. meters for one to nine families; ¾-in. for ten to fourteen; 1-in. for fifteen to twenty-four, and 1½-in. for twenty-five to forty.

Mr. French said that the Hackensack Water Company had got along well for several years with ¾-in. meters and ¾-in services for two-family houses. With pressures of 50 to 60 lb. the company had used with moderate satisfaction ¾-in. meters for five to ten families and had had sixteen to twenty families on a 1-in. meter. W. R. Edwards reported for his company that of 28,000 meters in use, 26,500 were on ⅝-in. meters. The company uses ⅝-in. meters for houses with up to six families; ¾-in. for from seven to twelve; 1-in. from thirteen to twenty-four. Up to this point satisfaction seems sure. On motion of W. W. Brush, it was voted to create a committee to report on the subject under discussion.

Standardization of Brass Supplies—Adolph Mueller, Decatur, Ill., pleaded for co-operation between the American Water Works Association and a standardization committee of the Brass Moulders' Association. It was voted to appoint a committee to co-operate with the one just named and also with a committee of the New England Water Works Association. Mr. Mueller gave statistics for states and groups of states which show that 128 cities have 332 different styles of corporation cocks. It appears that only three types (for iron threaded pipe, for tapping machine practice, and for wood pipe) are needed, with seven sizes in all, making 21 kinds, including size variations. The tendency now is to use larger corporation cocks than formerly. The minimum size under consideration by the Brass Founders' Committee is ⅝ in., but some as small as ½ in. are being made. The committee just named has already agreed on standards for a variety of plumbers' fittings.

Water-Waste Prevention on Railways—C. R. Knowles, Superintendent Water Service, Illinois Central Railway, traversed some of the same ground covered in a paper by him abstracted in *Engineering News-Record* a few weeks ago.

Ice Formation—In a volunteer paper illustrated by both lantern slides and moving pictures, John Murphy, Ottawa, Ont., showed how both anchor ice and frazil ice are formed. Ice formation with adherence to intake racks is a matter of 0.001 or even 0.0001 degree change in temperature, and may be prevented by a fuel expenditure that is only a small percentage of the cost of coal for steam power.

Standard Water-Works Contract Forms—An appeal for co-operation in reforming and standardizing contracts for water-works construction was presented in a paper submitted by the Association of General Contractors of America. The convention referred the appeal to the newly created Standardization Council of the association.

Chemical and Bacteriological Section—Co-operative research by water laboratories to solve all of the technical problems confronting the water-works field will be effected if a resolution of the Chemical and Bacteriological Section is put into effect by the newly-created Standards Council. The action followed Abel Wolman's paper on "Co-operative Research in Water Purification," abstracted elsewhere. John M. Goodell, speaking for the publication committee, indicated that this section and its activities would furnish the impetus to make the Council a success. The superintendents are in great need of scientific and technical men and their knowledge.

Jack Hinman, Jr., discussed standards and the present chaotic conditions the water-works officials are in with respect to them, particularly limit standards by which various Federal, State and municipal health regulating bodies judge of the acceptability of a water. Stress was laid on the sanitary survey as an adjunct to analysis.

W. J. Orchard, in his paper on "Recent Progress in the Fight Against Typhoid Fever," gave practically an extension to data in George A. Johnson's paper on "Typhoid Toll' presented to the Association in 1913. MacH. McCready, indicated how purification plants were controlled in Quebec.

Abel Wolman read by title Part II of a paper already in print in the Journal on "Index Numbers and Scoring of Water Supplies." It dealt mainly with the frequency distributions of B coli, whereas Part I referred to total bacterial content.

A volunteer paper on "Problems of the Dallas Filter Plant," presented by Helmen Rosenthal, chemist and bacteriologist, described the present difficulties being experienced in so many cities where ultimate capacities have been reached.

[*Extracts from the President's address and abstracts of two of the papers read at the convention follow.*—EDITOR.]

United Action in Water-Works Field

FROM PRESIDENTIAL ADDRESS BY CARLTON E. DAVIS
Chief of Bureau of Water, Philadelphia

I feel that the widest future opportunity for the American Water Works Association lies in a change in the relationship between the sections and the central organization. The sections must be developed. Those already in existence must be strengthened, new sections must be created, all with a view of a final amalgamation in one central organization of the entire water-works interests of the country. This process, carried to a logical end, will not destroy our existing organization but perhaps change its character, opening up to it a much wider field of usefulness along somewhat different lines. To meet the situations that are before us today and that will arise in the years to come, to prevent lost motion and eliminate unnecessary duplication, all the water-works of the country should function for their common interests through a central body which will be representative of all localities and which should be organized to meet all conditions and needs.

The American Water Works Association, when it adopted its name, expressed the intention to serve as this central body. The question before us today is whether we propose to grasp the opportunity to act or whether we shall let the opportunity pass us by. Acceptance of the present as we find it and committing the future to our successors is the easiest course. I believe our association will elect to follow the more difficult but more fruitful path.

FIELD FOR CO-OPERATIVE WORK

The majority of our members are restrained in their activities by regulations imposed upon them by public service bodies or by the restrictions of legislative enactments or by the limitations of city laws and ordinances. Many of these restraints are irksome and are not accepted calmly or without chafing under the restraint. Along the field of organization work we have a relatively free hand to organize and develop. We have an opportunity to demonstrate that the water-works engineer and operator is a capable organizer and when given the opportunity can conduct his own affairs with efficiency and at the same time with due regard for the interests and welfare of the public, with an eye to the future and an alertness for the present. Necessary protests against undue outside restraint will come with much greater force if supported by the weight of a compact, comprehensive, well-organized and conducted association.

It is stated on good authority that the investment in water-works represents the largest total in the entire field of comparable utilities. Water-works officials know that their plants, of all utilities, supply one universally, indispensable commodity, vital for human existence and basic for all community life. We have common interests, and that we are grasping for methods of expressing this interest by working together for a common end is shown by the number of water-works organizations. The next step forward is the affiliation of the several organizations to handle matters of mutual interest with the power and weight that come from large numbers, unity of purpose and harmony of ideas.

Organization is the dominant note heard throughout engineering and allied fields at the present time. The American Water Works Association, through accredited representatives, recently attended the Organizing Conference in Washington of engineering societies concerned with public utilities like our own, seeking to co-operate offensibly and defensibly in matters vitally affecting the interests, personal and official, of their members. Whatever may be the final outcome of such efforts, or whatever may be the path the council of affiliated societies may elect to follow, self-respect demands that the water-works of the country shall be able to speak as a unit at such councils and with the weight attaching to full and not partial numbers.

There is need for joint action and co-operation and it is for our association to decide whether it will be the leader among all water-works interests, and whether it will so conduct itself and its affairs that other water-works organizations will feel the call to join it without undue proselyting or the need of exerting pressure. I speak of proselyting as applying to associations and not to individuals, for no one can question the importance of increasing the membership in our own body.

WHAT THE ASSOCIATION NOW OFFERS

Considered dispassionately, in cold blood, what does the American Water Works Association as now conducted offer to its members?

First, the *Journal*, which in my opinion is serving more and more to develop the association, bind its members together, and attract increasing membership. Second, the privilege of attending once a year a convention which of necessity is geographically inaccessible to a large portion of its membership. Third, the opportunity of voting by letter ballot for officers. The association is likewise the medium for the production of various standard specifications and standards of practice and custom, a matter which I would like to refer to later.

All of these openings and results are admirable but the scope is limited and most of us must conclude that the association as now conducted is not the active help to water-works men that it should be and that it can be. Membership in it does comparatively little to promote the standing of the individual member in the community, protect him in a personal way, or place the utility which he conducts on the high level in the public mind to which it is entitled. The recognized official machinery of the association is too remote for the individual member and functions in too cumbersome a manner to respond to his needs or to be in his mind a tangible asset for his personal help.

The association naturally thinks of itself as a parent organization and the development of the sections may appear as the breaking up of the family tree and weakening of the main stem. I feel that the contrary will be the case, provided the central organization is willing to look upon itself not as a major factor but as a clearing house. Service rendered must be the underlying principle of the organization which attempts to weld into one functional activity the entire water-works interests of the continent.

We do not realize our strength because we have never attempted to exert it as a unit. Unorganized society is helpless against attacks and demands of relatively small but effective, because organized, groups working together. The existing lack of cohension among water-works men places them relatively in the position of the present unorganized public, powerful but helpless because of the inability to work together.

Standards of practice and procedure must be handled through committees, and committee work will become of increasing importance. The path of the committees must be smoothed as much as possible. When the authority for committee work can emanate from a central body, representative of all the water-works of the country, when co-operation comes logically and as a matter of course and not under option of possible rival organizations, as at present, the desired end will be in sight.

The War Burden on Water-Works Continues

By Leonard Metcalf
Consulting Engineer, Boston, Mass.

THROUGH the courtesy of their managers it has been made possible to extend to Jan. 1, 1920, the data submitted in 1918 and 1919 to this association, upon the trend of prices in the water-works construction and operating fields, based upon the actual experiences of about 50 water-works in various parts of the United States, having a gross annual revenue of about $34,000,000 and serving an aggregate population of upwards of 9,000,000.

Labor Costs—Unskilled labor costs (Table 1 and Fig. 1) continued their advance during the year 1919 and are yet higher to-day. The percentage of increase in cost per hour over pre-war (1915) prices averaged about 80 per cent—approximately 70 per cent in the western and central groups and 90 per cent in the eastern and southern. The average increases for the year 1919 over 1918 is about 12½ per cent. While the efficiency of labor is probably slightly better than during the war period, it is still far below pre-war standards. It is conservative to say that, taking productivity into consideration, as well as the price paid per hour, the cost of unskilled labor is more than double its pre-war cost.

Cast-iron pipe prices are today practically three times normal pre-war prices; the cost of *valves and hydrants* slightly less than double. *Coal* prices have receded somewhat, more nearly approaching the conditions of 1917 than 1918.

Wages paid unskilled labor by water-works in the vicinity of Boston in March, 1920, compared with 1919, show a nominal increase in rate per hour of from 43.2 to 50.6c. The actual increase, including allowance for holidays and vacation leave, is from 46.1 to 56.7c. per hour, or 21 per cent. Holiday leave under full pay is granted by 14 out of 20 works, while 17 out of 20 give two weeks' vacation annually under pay.

Table II shows the increases from 1915 to 1919 in (1) gross annual revenue, operating expenses, including taxes, and net annual revenue applicable to depreciation, interest, dividends and surplus of 46 works arranged in four geographical groups. The *net revenue* (see also Fig. 2), without deduction for and therefore applicable to depreciation, interest, dividends and surplus, has increased over the pre-war (1915) basis by 3.4, — 0.4, 4 and 8.5 per cent. This increase is less than half of what would be expected for such works in normal times. These figures indicate that in spite of the advances in rates, which have been granted in many places, the net revenue of the works is not adequate to command capital for their betterment over a long

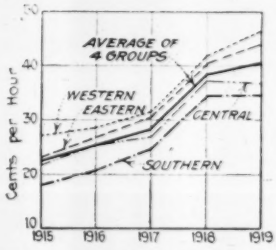


FIG. 1. INCREASED COST OF UNSKILLED WATER-WORKS LABOR

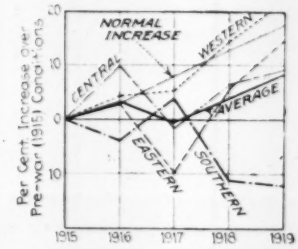


FIG. 2. PER CENT CHARGES IN NET WATER-WORKS REVENUE

period of time. They indicate further, as will be seen from the diagram, that of the net burden resulting from war conditions about half has been borne by the works; the other half by the public which they serve.

A segregation of the records submitted, as between municipally and privately owned works, indicates that the increase in gross revenue for both of these has been approxi-

TABLE II. PER CENT INCREASE OF GROSS REVENUES, OPERATING EXPENSES AND NET REVENUES OF FORTY-SIX WATER-WORKS, SINCE 1915

Group	1916	1917	1918	1919	1919* Revised
Gross Annual Revenue					
Eastern	10 1	12 8	20 6	23 3	23 3
Central	9 1	11 4	26 4	(33 7)*	23 3
Southern	7 5	20 3	26 3	26 3	26 3
Western	7 3	9 5	17 5	25 0	25 0
Average	8 5	13 5	22 7	(27 1)*	24 5
Operating Expenses, Including Taxes					
Eastern	21 9	41 1	49 7	47 1	47 1
Central	9 3	37 3	62 3	(75 5)*	63 1
Southern	9 7	34 6	65 9	71 5	71 5
Western	9 9	17 4	28 0	36 1	36 1
Average	12 7	32 6	51 5	(57 5)*	54 4
Net Revenue Applicable to Depreciation, Interest, Dividends and Surplus					
Eastern	3 0	—9 6	5 8	14 5	14 5
Central	10 0	—1 5	6 5	(36 5)*	9 3
Southern	—3 7	4 0	—10 9	—12 0	—12 0
Western	4 3	5 3	14 4	22 1	22 1
Average	3 4	—0 4	4 0	(15 3)*	8 5

*The figures within brackets cover all records received. The figures beside them are believed to be more characteristic however. They result from the exclusion of two very abnormal records. Those of Detroit, Mich., and Mingo Junction, Ohio.

TABLE I. INCREASE IN COST OF UNSKILLED LABOR AND MATERIALS TO FORTY-SIX WATER-WORKS IN THE UNITED STATES, FROM PRE-WAR BASIS, 1915 TO JAN. 1, 1920

Item	Number of Records on Diff. Years	Prices per Unit, Cents 1915	1916	1917	1918	1919	Per Cent Increase Over 1915 (Pre-war Basis) 1916	1917	1918	1919
Unskilled labor, per hour:										
Eastern group	15-18	23 0c.	26 7c.	30 4c.	40 2c.	43 8c.	16	32	75	91
Central group	10-12	21 7c.	25 3c.	26 9c.	37 2c.	36 8c.	17	24	71	70
Southern group	9-12	17 9c.	20 6c.	24 5c.	34 3c.	34 4c.	15	37	92	92
Western group	7-8	27 0c.	28 5c.	31 4c.	41 8c.	46 4c.	5	16	55	72
Average of groups		22 4c.	25 3c.	28 3c.	38 4c.	40 4c.	13	27	71	80
Cast-iron pipe per 2,000 lb., approx	17-21	$24 23	$30 70	$51 60	$67 74	$69 20*	27	113	179	184
6-in. valves	11-38	11 18	12 64	19 13	19 13	20 73	13	71	71	85
12-in. valves	3-38	34 78	41 53	65 22	65 02	59 66	19	88	87	72
2-way hydrants	6-38	26 69	32 04	43 13	51 80	47 16	20	62	94	77
Coal per 2,000 lb.:										
Eastern group	13-15	$2 98	$3 80	$5 96	$6 00	$5 41	27	100	101	82
Central group	11-12	2 41	2 77	3 75	4 53	4 55	15	56	88	89
Southern group	12-9	1 92	2 01	3 03	3 89	3 78	5	58	102	97
Western group†	5-4	3 97	4 37	6 31	7 92	4 70	10	59	99	18†
Average of groups		$2 82	$3 24	$4 77	$5 57	$4 61	15	69	97	63
Fuel oil, per gal., South	1	1 80	1 80	2 00	4 28	.....	0	11	138	
Fuel oil, per gal., West	1-4	1 38	1 50	2 57	4 05	4 09	9	86	193	197
Alum, per lb.:										
Eastern group		$1 12	1 72	1 48	1 45	1 66	54	33	29	48
Central group		0 91	0 91	1 25	1 50	1 40	0	37	65	54
Southern group		1 08	1 38	1 48	1 78	1 56	28	37	65	44
Western group		1 14	1 21	1 51	1 53	1 79	6	32	34	57
Average of groups		1 06	1 30	1 43	1 56	1 60	22	35	47	51
Average N. Y. price		2 08	4 63	3 57	.....	.....	...	...	...	..

* Range $50.60 to $83.50 per ton. † Small number makes record of doubtful value.

mately the same; that the increase in expenses has been more than twice as great for the privately owned group as for one municipally owned; and that the net revenue of the privately owned group has practically stood still while the municipally owned group has been increased approximately 40 per cent. This comparison cannot be carried too far, however, as the list of municipally owned works is not sufficiently large to be thoroughly characteristic. Moreover, in the case of the municipally owned works, the records of which are included, a much greater proportion have gravity supplies than in the case of the privately owned group. This has served to minimize the increase in expenses which would otherwise have been felt. It may be that the decrease in available labor during the war period had a more material effect upon the municipal works than upon the private works and resulted in economies which would not have been possible in those public works under normal conditions. More important yet, it is to be observed that in the case of the municipal works substantially no taxes are paid, whereas in the privately owned group the taxes generally amount to about one-eighth of the entire gross revenue, and these taxes have, of course, been burdensomely increased since the war burdens began to make themselves felt. In fact, excluding the returns from water-works located in the State of Pennsylvania, because the basis of taxation is quite different there and incomparable with that prevailing in other states, it appears that the increase in taxes paid by privately owned works in 1919 over 1915 was 68 per cent.

Summit of High Prices Reached—It is generally conceded that the summit of the high prices has been reached, where it has not been passed, and that, as to materials at least, and probably in lesser degree as to labor also, some recession in price is to be looked for. There is still, however, so marked a shortage of materials and labor, comparable with the demand, that construction costs are certain to remain high during the year 1920.

The financial outlook for existing water-works is not encouraging. It is evident that the earnings during the war period have not been adequate to maintain the properties and pay a fair return upon their value. Such a condition cannot long continue without serious future embarrassment. The position that may be taken by the public service commissions will be reflected later in the character of the service rendered. If fair advance in rates be granted, first class service can be maintained. If this advance be retarded or be not adequate, a declining service must result. The increase in rates in the face of the present high cost of living will be very distasteful to the public and in some cases induce active opposition. Therefore it is important that in making application for relief, the evidence should be clearly presented by the water-works authorities, so that the facts may speak for themselves and the difficulties of the commissions be minimized.

Co-operative Research in Problems of Water Purification

By Abel Wolman
Division Engineer, Division of Special Investigations, Bureau of Sanitary Engineering, Maryland State Department of Health, Baltimore, Md.

SCIENTIFIC investigation in the field of water purification has progressed for a number of decades, but the study of problems has been, for the most part, intermittent, sporadic and disconnected. The development of data has been the result of local efforts in the laboratories of individual colleges, states, municipalities, or private corporations. What co-operation has existed has been localized and not national. It seems hardly necessary to emphasize the abstract desirability of solving the problems of water purification by a more constructive system of co-operative effort than now exists. It should not be a difficult matter for the American Water Works Association to plan the attack on a series of problems by the proper organization of a research committee. As far as I am aware, no other organization is at present so well suited to undertake its development and no other has yet deemed it desirable to assume this responsibility.

Granting the abstract desirability of developing such co-operation, what are some of the problems which to-day remain to be solved? Although considerable advance in the practical methods of water purification has taken place in the United States, may we state definitely that the fundamental laws of coagulation, filtration and chlorination are accurately known? If so, are these laws applied in every-day operation? Some of us, perhaps, are not so sanguine about our complete understanding of the processes involved in the above mechanisms of purification. An opportunity to engage in a co-operative attack upon such problems will be welcomed.

Unsolved Problems in Water Purification

Coagulation and Sedimentation—The factors determining effective coagulation and sedimentation of waters differ in degree with different waters, but their characteristics in general are the same, regardless of the nature of the water. The effects of time, temperature, agitation, and hydrogen-ion concentration upon coagulation have been studied only superficially. The material for such study has been accumulated in a number of different fields in allied sciences, but has not yet been adapted to water purification problems. It is stated often, for example, that the formation of satisfactory floc is retarded by low temperature and by inadequate agitation, yet how many plants observe and record the nature of the floc produced each day, so as to provide the material for correlated study of its variations with other characteristics of the water during an entire year?

The measurement of floc formation in its various aspects, however, should be preceded by a study of the raw waters with a view to determining a more accurate and satisfactory method of apportioning coagulant to raw water to obtain satisfactory coagulation. The usual method of turbidity reading with adjustments for rising, falling, constant, fine, medium, and coarse turbidities leaves much to be desired, particularly when frequently the actual procedure results in abandoning all methods other than adding chemical until the coagulation becomes satisfactory. These methods are necessarily wasteful, since for each water there exists a critical concentration of coagulant which is most effective and economical. Can we not devise a satisfactory index to the "coagulant demand" of a water by a simple test? When it is borne in mind that the flocculation of waters is dependent upon the nature and amount of fine particles present it would appear that the search for such a measure should be in the field of colloid chemistry.

Another phase of the coagulation problem which has taken on an importance in recent years is the effect of the varying hydrogen-ion concentration upon flocculation. There appears to be an optimum range of P_H within which the coagulation proceeds most satisfactorily. Water-works operators and investigators should begin to accumulate complete data regarding the P_H values of different waters in the country under all conditions. In the State of Maryland we have been making, for several months, determinations of hydrogen-ion concentration on all waters and have instituted these tests as a daily procedure in several large filtration plants.

The study of sedimentation problems in the light of recent developments in physical chemistry may require some modifications of our older concepts. The effect of electrolytes, of competing and protective colloids, of surface tension and osmotic pressure are of more than purely scientific interest. Recent work has demonstrated, for instance, that the Brownian movement is observed with practically every type of clay suspended in water, varying from the rapid motion of the finest particles to the more sluggish one of the larger particles or aggregates or when hampered by the presence of electrolytes.

Filtration—The internal forces within a sand filter bed are of greater magnitude than is generally realized. Experience in Maryland with a number of peculiar phenomena in filter beds has disclosed a startling variety of forces released in filter beds, which appear to be intimately connected with the character of sand and of applied water. The appearance of internal contraction in a sand bed of such strength that the

surface area of the bed may be reduced by more than 5 per cent of its original area is of importance in calling attention to the unsolved problems concealed within the bed.

Chlorination—Sanitarians have established definitely that waters may be made safe for potable purposes by chlorination. The water-works official, however, must go a step further. He must make the water potable as well as safe. If the water is unpalatable and objectionable because of tastes and odors, then the problem of chlorination may not be considered as solved. It is only a few years since the conception of the mechanism of chlorine treatment has undergone some modification from the simple hypothesis of direct oxidation. But in this comparatively short period, a series of questions have arisen which are still imperfectly answered.

In this field again we must have recourse to highly technical investigations to aid us in clarifying our concepts of chlorination processes and in controlling their operation. Even to-day it is difficult to answer definitely whether the action of chlorine is physical, physico-chemical, or chemical, whether its action is selective for different types of bacteria and, if so, what the causes for such selection are. The action of other disinfectants is elective and their toxicity is dependent upon their position in definite ionic series and upon the characteristics of the different bacteria, such as their response to Gram stain. The surface character of different classes of bacteria show a marked influence upon their behavior under different conditions.

Where we attempt to treat raw waters of complex organic and inorganic content, our present methods of control are entirely empirical and not infrequently unsuccessful. The causes of tastes with low doses and the absence of tastes, at times, with excessive doses of chlorine are still in the category of the unknown. It is not a solution of the difficulty to state that tastes and odors may be prevented by proper regulation of applied chemical, for the terms "proper regulation" are indeed broad in interpretation. Proper chlorination control, on the contrary, would seem to be possible of attainment only after a complete understanding of the details of the complex disinfection processes has been reached. May we not call upon this Association to take the lead in the initiation of these studies?

Seeing Ourselves as Others See Us

ONE reads about the construction of sewers in America, and one marvels. Are our methods completely out of date, or are the Americans in the habit of constructing works in a costly and dangerous manner? Experience of recent American practice does not justify the conclusion that the work is faulty, or that the methods whereby rapidity of construction is obtained are extravagant. There is very little doubt that in this country engineers are too apt to act on precedent, and to leave to the contractor and the contractor's foreman a great deal of work which could be done much better by the engineer. The contractor is very often a person whose knowledge and experience are much less than his commercial ability and assurance; it is more than probable that he relies almost entirely upon his foreman. In any case his business is not, as a rule, limited to one job. At the best his attention must be divided. Thus, the details upon which the speed or economy of the work depend are left to the judgment of the foreman. The average foreman cannot compare in intelligence or knowledge with the properly qualified engineer. We, as engineers, look at his work, and we think that we could see ways of speeding things up or of saving money; but, as a rule, we do not interfere with time-honored methods hallowed by precedent. Therefore the work takes much longer to execute, the timbering of trenches has to be of a character to stand for months, the cost of pumping becomes excessive, and many other troubles incidental to delay occur.

A study of American methods as illustrated by work recently carried out at Granite City, Ill., described in *Engineering News-Record* [March 4, 1920, p. 461], shows an enormous difference between English and American practice. The work at Granite City may be open to criticism, but it is nevertheless worthy of consideration, as it is typical of much other work. We read of a concrete sewer, 8 ft. in diameter, being constructed on a bad foundation consisting of quicksand in some places, at the rate of 35 ft. in 24 in., including excavation and refilling. The depth of the trench ranged from 15 ft. to 22 ft. How many of us have seen a trench 15 ft. deep containing a 12-in. sewer left open for months owing to our slow methods! Surely the difference is remarkable. We read of heavy pumping in the Illinois trench. Excavation and refilling were done by means of a grab bucket and moving crane. In good ground only the lower part of the trench was timbered. Planks, 2 in. by 12 in., driven by hand assisted by water jets were used. The joints below the water line were covered with batten strips 1 in. by 6 in. in size. An electrical pump kept the trench water low. The bottom of the trench was levelled by men with shovels, and the concrete base of the sewer was dumped without waiting for the trench to be entirely dry. Collapsible steel forms were fixed, and concrete was dumped from a traveling car fed from a mixer alongside. The work was done in 35-ft. lengths, and the forms were withdrawn after the concrete had been laid twelve hours. Whatever may be our view of such methods, it is certain that an enormous amount of pumping, timbering and troubles incidental to a lengthy process must have been avoided.

Whether our methods will ever be speeded up on American lines or not, it is certain that such speeding up can only be done by engineers. Undoubtedly a material improvement could be effected if engineers of suitable experience accepted the responsibilities usually taken up by foremen of inferior knowledge. If engineers did their legitimate work, it is obvious that they would take up much that is done by workmen who, for lack of knowledge, carry out their work by slow and timorous methods. We should not then be faced with the fact that, while many good engineers are out of a job, there is a demand for foremen, who are offered pay equal to that of an engineer. Why do we allow the ignorant so-called practical man to do our work, and leave us unemployed, while the work suffers?—*The Surveyor and Municipal and County Engineer, London.*

What Is Dry Rot?

The term "dry rot," the U. S. Forest Products Laboratory finds, is applied by many persons to any decay which is found in wood in a comparatively dry situation. Thus loosely used the term actually includes all decay in wood, since wood kept sufficiently wet can not decay.

In the more limited sense in which pathologists use the term, "dry rot" applies only to the work of a certain house fungus called *Merulius lachrymans*. This fungus gains its distinction from the fact that it is frequently found growing in timbers without any apparent moisture supply; in reality it does not grow without moisture and is as powerless as any other fungus to infect thoroughly dry wood. Given moist wood in which to germinate, it is able to make its way a surprisingly long distance in dry timbers, drawing the water it needs from the moist wood through a conduit system of slender, minutely-porous strands.

Wood in the typical advanced stage of dry rot is shrunken, yellow to brown in color, and filled with radial and longitudinal shrinkage cracks, roughly forming cubes. In many instances these cracks are filled with a white felty mass, the interwoven strands of the fungus.

The dry rot fungus is active in nearly every region of this country, in Canada, and in Europe. It is very destructive to factory and house timbers and to logs in storage. Coniferous or soft woods are more commonly infected by it than hardwoods.

Annual Meeting of American Society for Testing Materials

Expansion of Committee Work and Great Growth of Co-operation with Other Societies Mark the Year's Developments — President Capp Urges Cultivation of Research — Waiting Attitude Toward Federation

PROPOSALS for a radical change in the general working plans of the American Society for Testing Materials were made by the retiring president, J. A. Capp, in his presidential address at the society's annual meeting last week. Held in a new meeting place, Asbury Park, N. J., in place of the traditional one of Atlantic City, and following upon a year during which many important changes affected the society's life, the meeting was of distinctive character. That interest on the part of the membership is not decreasing was made evident by the attendance, which approached the record figure of last year, about 650 present. In one sense, however, the meeting resembled a committee convention rather than a society gathering, as more than fifty sessions of committees and subcommittees were held during the week, among them the meetings of a number of committees of other societies and intersociety committees.

Research and Specification Work

Dividing the whole field of the society's work into standardization and research—the latter being directed toward increasing our knowledge of the properties of materials and our ability to measure these properties by test—President Capp asserted that standardization by means of the drafting of specifications has been cultivated energetically and successfully, while research has been left to individual initiative. Partly as a result of this, we are today distinctly behind the requirements of technology and engineering with respect to knowledge of materials and ability to select the right material for a new service, as well as skill in applying tests to determination of quality to suit the required service. For these reasons he suggested organized development of the field of research on the part of the society. Ways and means of doing this were not proposed, but he suggested that if the society devoted as much energy to research as to standardization, the results in the two departments would be more commensurate.

As a measure of the extent to which committee work has progressed, the fact may be cited that at the Asbury Park meeting not far from 100 specifications were dealt with: 28 new specifications were proposed (and adopted) as tentative, 24 earlier tentative specifications were advanced to the rank of standard, and in addition changes were made in 13 tentative and 23 standard specifications of earlier dates. Contrasting with the volume of this work, its importance is probably less than that of the work accomplished in some prior years, as many of the investigations and revisions were concerned with minor subjects or with slight detail clauses.

Technical papers on materials, test methods, and machines or instruments for use in testing made up about one-half of the program of the meeting, as at previous meetings. Various new facts on the properties or the behavior of different materials were brought out, and a dozen or so of new testing instruments and machines was described. One or two papers on the purely scientific side of technology and a number of papers verging on the broader field of engineering manipulation of materials were included.

Three representatives of the society attended the June 3-4 conference at Washington, where the Federated American Enginering Societies was created. The report of these representatives was considered by the Executive Committee in the course of the meeting, and that committe's conclusions announced to the society by President Capp. The authorities were much impressed with the desirability of the federation, he stated, but the conference was so recent that there had not been time to prepare a formal statement for discussion at the meeting. A circular will shortly be issued to the members presenting the history and present status of the whole matter and including also a questionnaire on the various elements of the proposition, through which the Executive Committee will learn the sentiment of the membership as a guide to its attitude. "Our sympathies," said President Capp, "are with the movement." It is possible that a letter ballot on certain definite proposals will be sent out, in case it is thought desirable for the society to take final action this year.

Events of the Year

Independent society headquarters were established during the past year in Philadelphia, in the house of the Engineers Club; during the preceding 22 years of its history the society was directed from loaned offices in the University of Pennsylvania. Within the last twelve months also the society joined in the formation of the American Engineering Standards Committee, and in fact one of its former presidents, A. A. Stevenson, is chairman of that committee. Despite the increase of expense involved by these changes, with a contribution of $1,200 to the Standards Committee and $1,000 to Engineering Council, and in the face of greatly increased publication and management costs, the society showed a surplus of $6,200 for the year after deduction of a $2,000 sinking fund toward the triennial book of standards.

One sore question that has dogged the work of several committees of the society for a number of years was disposed of some months ago by action of the Executive Committee, announced at the meeting. It concerns the inclusion of clauses governing engineering design or construction in a specification for material. The question arose at various times in connection with drain tile, sewer pipe, lime, and gypsum. After consideration of the principles involved the Executive Committee made the declaration that specifications for engineering work should not in general be included in the society's material specifications. As a result of this action the gypsum committee abandoned plans to prepare descriptive specifications of methods of applying gypsum plaster and the like.

George S. Webster, of Philadelphia, was elected president for the coming year; G. K. Burgess, of the Bureau of Standards, Washington, vice-president; and L. G. Blackmer, of St. Louis, D. E. Douty, of New York, Prevost Hubbard, of Washington, and R. S. Whiting, of Chicago, as members of the Executive Committee. A. A. Stevenson retired from the Executive Committee, under constitutional limitation, after nine years service as

officer, including one term as president of the society, the longest service in the society's history. Resolutions of appreciation were passed in recognition of his devoted and efficient work.

Co-operative Work on Specifications

Various committees of the society have worked in co-operation with other societies in the past, but so much new co-operation was set on foot since the 1919 meeting as to give this phase of the specification work a distinctly new status. Most interesting of the items, besides the formation of the American Engineering Standards Committee, is the organization of the new Joint Committee on Standard Specifications for Concrete and Reinforced-Concrete, in co-operation with the American Society of Civil Engineers, American Railway Engineering Association, American Concrete Institute, and Portland Cement Association. The society is represented on this committee by R. L. Humphrey, A. T. Goldbeck, E. E. Hughes, L. S. Moisseiff, and H. H. Quimby, Mr. Humphrey being also chairman of the Joint Committee. This committee was in session during the meeting, almost continuously, endeavoring to outline its program for completion during the current year.

Important cooperation with railroad organizations was started, a new departure. A general scheme of co-operative procedure was formulated by the society and the Mechanical Section of the American Railroad Association, which is to guide joint standardization work in various special subjects. Under this plan a joint committee on Steel Castings for Railroads has already been organized. In work affecting the American Railway Engineering Association it was not possible to arrange for joint-committee work, but exchange of views and other informal co-operation between committees of the two organizations dealing with the same subject was successfully established. The most important items affected at present are steel rails and tie plates. Steps were taken to initiate joint work with the Society of Automotive Engineers in standardization of aircraft steels, but the future of this work is doubtful. Constant touch is maintained with the Boiler Code Committee of the American Society of Mechanical Engineers, in order to keep the requirements of the boiler code and the other codes being developed by that committee in harmony with the specifications of the American Society for Testing Materials.

Concrete culvert pipe is being dealt with by a joint committee of the society, the American Concrete Institute, American Association of State Highway Officials, American Railway Engineering Association, American Concrete Pipe Association, American Society of Civil Engineers, and U. S. Bureau of Public Roads. Standard pattern practice is under consideration by a newly organized committee of the American Foundrymen's Association, National Association of Pattern Makers, Steel Founders' Society of America, American Malleable Castings Society, Metal Division of American Institute of Mining and Metallurgical Engineers, and American Society for Testing Materials. The society also maintains representation on the American Bureau of Welding and the Conference for Standardization of Technical Symbols.

Research into the influence of sulphur and phosphorus on steel quality is doubtless the largest and costliest item of co-operative work begun during the past year. This research is in charge of a joint committee (organized six months ago) of the society, the Bureau of Standards, American Railroad Association, Society of Naval Architects and Marine Engineers, Association of American Steel Manufacturers, War Department, Navy Department, Steel Founders Society of America, and Society of Automotive Engineers. As has already been reported, a full program of the initial test series has been developed, and the steel for the tests has in large part been melted and rolled; tests are now being started.

Close contact is maintained by the society with the Engineering Division of the National Research Council, in which the society has a representative. A research committee of the Engineering Division on the subject of high-speed tool steels is in touch with one of the subcommittees of the society. Another research committee on road construction and highway economics maintains similar contact. It is expected that the society will be represented in the Engineering Division's proposed research work on heat treatment of steels. On the other hand, the Engineering Division has turned over all research in magnetic analysis of steel to a committee of the society.

American Engineering Standards Committee

Standardization of rolled structural steel shapes has been organized under the direction of the American Engineering Standards Committee within the last six months. The society is not directly represented in this work but keeps in touch with it through a committee.

In the development of the work of the American Engineering Standards Committee, seven organizations have acquired representation in addition to those which founded the committee. These additional ones are National Safety Council, National Fire Protection Association, National Board of Fire Underwriters, Associated Factory Mutual Fire Insurance Companies, Electrical Manufacturers Council, National Electric Light Association, and Society of Automotive Engineers.

Two standards of the American Society for Testing Materials have already been accepted as tentative American standards and five others have been proposed to the Standards Committee. None of these include steel specifications, but a number of specifications for steel, iron, and non-ferrous metals are shortly to be proposed for grading as American Standards.

With a view to harmonizing its work with an important development reached by the Bureau of Standards, the Executive Committee of the society adopted the series of standard testing sieves worked out by the bureau, and all of the society's technical committees are now working to use this standard series in their specifications where sieves are mentioned. The Executive Committee also considered adoption of the practice of expressing all measurements in the society's specifications in both English and metric units. This subject, however, is under reconsideration.

New Tentative Standard Specifications

That a wide range of technical activities was covered by the new standardization carried out in the committees during the past year is to be seen from the following list of specifications presented for the first time. All of them were accepted by the society as tentative standards.

Commercial bar steels.
Sheet high brass.
Aluminum for use in manufacture of iron and steel.
Gypsum plasters.
Turpentine.

Wooden boxes, nailed and lock-corner construction.
Adhesive insulating tape.
Workability of concrete for concrete pavements.
Commercial sizes of broken stone and broken slag for highway construction.
Commercial sizes of sand and gravel for highway construction.
Broken slag for waterbound base.
Shovel-run or crusher-run broken slag for waterbound base.
Natural or artificial sand-clay mixtures for highway surfacing.
Method for ultimate chemical analysis of chrome ores and chrome brick.
Method for making and storing specimens of concrete in the field.
Test for unit weight of aggregate for cement concrete.
Method for determination of voids in fine aggregate for cement concrete.
Test for specific gravity of road oils, road tars, asphalt cements and soft tar pitches.
Test for specific gravity of asphalts and tar pitches sufficiently hard to be handled in fragments.
Test for quantity of clay and silt in gravel for highway construction.
Test for quantity of clay in sand-clay, topsoil and semi-gravel for highway construction.
Test for quantity of clay and silt in sand for highway construction.
Methods for sampling of stone, slag, gravel, sand and stone block for use as highway materials, including some material survey methods.

Important Items of Committee Work

Only one new specification was prepared by the Steel Committee (A1) during the year, this applying to commercial bar steels. The well advanced condition of standardization work suggested by this fact appeared to be reflected in the results of most of the other specification committees. Revision of existing specifications was done on a very extensive scale, however. In most cases the changes made were of minor character or in individual detail clauses. This was true of the work of the Steel Committee, but here the revision of two detail items took a prominent position, in one case on account of the very broad importance of the subject, and in the other case because of a conflict that developed in the committee.

Retain Increased Sulphur Allowances

By far the most significant action of the Steel Committee related to one result of the war emergency conditions, namely, the relaxation of sulphur and phosphorus rejection limits by 0.01 per cent (for sulphur in all steels, for phosphorus only in acid steels) two years ago. It has been necessary under the condition of intensive steel production during the war to use less pure fuel and ore than in normal times, in consequence of which it became difficult or impossible to maintain the usual low limits on the two prime impurities in steel. Raising of the rejection limits by the society followed, but at the 1919 meeting the former (low) limits were restored in all classes of steels that were considered specially sensitive to the influence of sulphur or phosphorus. As for the remaining specifications (14 in number, including such important classes of material as steel for buildings and ships, boiler tubes, and steel rails), the restoration of the low limits was postponed until 1920. When the special research into the influence of sulphur and phosphorus was organized, six months ago, a further postponement of the restoration was expected in some quarters. However, the action to be taken remained uncertain until a day before the society's meeting, when the Steel Committee decided to recommend that reduction of the rejection limits in these fourteen specifications be deferred another year. The committee's stated reason was that the difficult industrial conditions which originally called for the increase still obtain. The quality of ore, scrap and particularly fuel is still so unsatisfactory as to make it impracticable, it is said, to work to the former low limits in all classes of steel. Moreover, a change for the better in this condition does not appear to be in sight. The society approved the sulphur and phosphorus recommendation by accepting the committee's report in its entirety.

Overweight of Wide Plates—New industrial conditions made it necessary to revise the existing specification table of overweight allowances on very wide steel plates (132 in. and over in width). This table was intended to apply essentially to widths up to about 144 in. Several mills have recently installed plate rolls of much larger capacity and the allowances of the table no longer correspond to actual overweights. It was proposed in the committee, therefore, that the table be limited to widths from 132 in. to 144 in., and that pending determination of actual overweights individual agreement be relied upon as to wider plates. The proposal was later withdrawn.

Magnetic Analysis of Steel—Experiments aiming to determine the applicability of magnetic analysis to the detection of flaws and non-uniformity in finished steel parts were reported by the committee on this subject (A8). Results of the tests will not be given until next year although twenty-seven railway rails have already been examined. A total of 102 standard rails will be tested, including direct-rolled rails and others rolled from reheated blooms. Other work has been started on forged vane-wheels of steam turbines, on steel pinions for automobiles, on welded joints, on manganese steel, and on the subject of granular structure of steels.

Copper-Steel and Corrosion

New data on the corrosion of different iron and steel sheets were reported by the committee on Corrosion of Iron and Steel (A5). Sets of 16-gage and 22-gage sheets are exposed at Fort Sheridan, Ill., Pittsburgh, and Annapolis, since the early part of 1917. In the two former locations, many sheets have rusted sufficiently to be reported as "failed," and the present showing is strongly favorable to copper-bearing metal.

At Pittsburgh, where the most severe exposure is obtained, the result at the May, 1920, inspection was as follows: Out off 146 sheets of copper-bearing steel and iron (including puddled and ingot iron, open-hearth and bessemer steel, all with copper content above 0.15 per cent, ranging from 0.18 per cent to 0.62 per cent), 42 have failed, or 28 per cent. Out of 84 non-copper-bearing sheets (copper content below 0.15 per cent, ranging from 0.01 per cent to 0.14 per cent), 81 have failed, or 97 per cent. This is after 41 months' exposure.

Tests of exposure of the same materials in salt, acid mine and normal (tap) water are about to be started as a check on the atmospheric-exposure results. Exposure tests of galvanized sheets may also be undertaken.

Nomenclature of Bronze and Brass

Of the large amount of work done by the committee on non-ferrous metals, practically all was in detail revision except for a new specification defining aluminum for use in the manufacture of iron and steel. A new, radical, terminology for brasses and bronzes was proposed by the committee. Leaning on the recommendation of the British Institute of Metals, the committee proposes to designate each alloy by its constituents (for example, lead-zinc-copper, to describe a brass with lead content of 1 per cent), with an added color description

(yellow brass, red brass, yellow-red brass); and for ...nzes (tin-copper alloys containing over 50 per cent ...pper) with the principal modifying element as pre-... It also proposed to designate all metals of the ...erman silver type by the work "nickelene"; and copper-...ckel alloys by the term "cupro-nickel" with proper ...efix or prefixes (as iron-manganese-cupro-nickel).

Paint and Oil

The committees on paints and oils offered little that was new. Committee D-1, on Preservative Coatings for Structural Materials, besides doing a considerable amount of detail work on paint materials is attacking a new problem with a recently organized subcommittee on Specifications for the Fundamental Requirements of Paint for Specific Purposes. The committee has also followed the work of the Government interdepartmental committee on Paint Specification Standardization, and is shaping some of its own work accordingly. Committee D-2 on Lubricants, hereafter to be called Petroleum Products and Lubricants, presented the scientific results of investigations by subcommittees on sulphur determination and emulsification, the latter including a new test for emulsification.

Douglas Fir Specifications

Definite advance was made by the Timber committee (C-7) through a complete change in its existing specification for Douglas fir timber. Previously this specification referred only to bridge and trestle timbers, and while based on a density rule something similar to the modern grading rule for Southern pine, it proved in practice to be defective. The new specification covers all structural uses of Douglas fir, and classifies the material into dense and not dense (corresponding to the dense and sound yellow pine). Dense Douglas fir shall show on one end or the other an average of six rings per inch and at least one-third summerwood measured on a 3-in. radial line; but coarse-grained material will be acceptable if the amount of summerwood is at least one-half. There are detail rules for applying these measurements, and clauses defining the various permissible defects and the locations in cases of different use where specified defects may or shall not be present. No. 1 and No. 2 structural grades are defined in terms of density and defects. A table of working stresses is appended.

Specifications for wooden boxes, nailed and lock-corner construction, were presented by Committee D-10, on Shipping Containers. These are of new type. They classify woods in four groups, from soft to hard, state thicknesses for the different groups, thickness of cleats, and size and spacing of nails.

A specification of method for testing textiles was proposed by Committee D-13 on Textile Materials and was accepted by the society. This is notable for specifying six testing machines of different capacities for the test of fabrics of different strengths. The several machines, for fabrics of maximum strength ranging from 25 to 650 lb. per inch of width, are limited to capacities of 50 to 800 lb.

Committee D4 on Road Materials was among the most active in the presentation of specification and tests. Four tentative standards were offered for adoption as standard, and five new tentative tests, one tentative method of sampling and six tentative specifications were proposed. In spite of a considerable opposition from the floor to the proposals affecting concrete all of the recommendations by the committee were adopted.

The new tentative tests cover a variety of road materials ranging from specific gravity determinations for oils, tars, asphalts and pitches to quantity of clay in various earthy road material. The new tentative specifications cover commercial sizes of broken stone and broken slag, sand and gravel, specifications for broken slag for waterbound base and for shovel run slag for the same purpose and finally for natural or artificial sand-clay mixtures for highways surfacing. All of the foregoing were adopted with little or no discussion but two proposed specifications on concrete grading and consistency were opposed.

The first of these was preprinted as Proposed Tentative Specifications for Proportions for Concrete for Highway Construction and presented, in mandatory specification form, the various proportions producing a 3,000-lb. concrete as determined by Professor Abrams at Lewis Institute and as published in *Engineering News-Record*, May 13, 1920, p. 964. Before presentation, however, the committee withdrew the tables in their specification form and asked permission to print as an appendix to the report. This was opposed by Richard L. Humphrey, chairman of committee C-2, who contended that the subject covered was specifically concrete, though in its application of interest in road construction, and that therefore publicity should not be given to the matter without conference with committees C-2 and C-9 who are more definitely interested in it. The same argument was made in reference to a proposed tentative specification for Workability (in the preprints, "Consistency") of Concrete for Concrete Pavements (in the preprints, "for Highway Construction"). This is in effect a specification for the "slump" test, and was opposed not only on account of jurisdiction of the committee but also on account of the invalidity of the test. The committee, however, had foreseen such opposition and had obtained a ruling from the Executive Committee to the effect that in this particular case, judgment must be rendered from the floor. By a vote of approximately 40 to 10 the committee was sustained.

Cement and Concrete

Of great importance in the history of the society and of the concrete industry is the announcement of Committee C-1 on Cement that a single American standard specification for cement is in sight. This has been the goal of many years of endeavor but complete achievement has been delayed because of the proposal of the United States Government Departmental Committee to specify, to take effect next January, a fineness with a permissible 20 per cent residue on a 200-mesh screen, as against the Society standard of 22 per cent with a 1 per cent tolerance. In its report this year Committee C-1 announced that after a conference with the government committee it recommended that the 1 per cent tolerance clause be removed from its specification, the intimation being, though it is not directly stated, that the government will withdraw its 20 per cent clause and a universal cement standard will be adopted in which the required fineness on 200-mesh screen is no less than 78 per cent.

Committee C-9 on Concrete and Concrete Aggregates presented three appendices to its report, observations on the effect of organic impurities on concrete, noted on p. 1244 of last week's issue, on methods, of making

compression tests of concrete, and on weight, voids and consistency. The second of the two noted carries nearer the specification stage the adoption of compression tests of concrete. It discusses in some detail such controversial points as quantity of mixing water, consistency or mobility, and proportioning methods. The committee announced that a co-operative series of tests in different laboratories for the study of these controversial matters has been outlined. The committee submitted three tentative tests.

Committees C-4, Clay and Cement Sewer Pipe; C-3, Brick; C-7, Lime and C-8, Refractories, reported little other than the routine specifications noted in the earlier table, either to be advanced to standards or presented as tentative. It is noteworthy that C-4 announced that by letter ballot it had agreed that the specifications for clay sewer pipe and for cement-concrete sewer pipe be presented to the society as separate forms, thus ending a long dispute. C-11, on Drain Tile, has revised its Standard Specifications for Drain Tile, although that standard had been submitted by the society only a few months ago to the American Engineering Standards Committee. The revision consists in taking out from the freezing tests of tile the provisions for previously boiling the specimen. It has been found that this practice causes a considerable decrease in the strength of concretes, even those of some age, and has some slight adverse effect on clay tile.

Committee C-11, on Gypsum, has been very active, as the submitted revisions in tentative specifications attest. In the specifications for gypsum plasters the committee has made the revisions required by the ruling of the executive committee that methods of construction practice do not come under the authority of the society. The same ruling caused Committee C-7 on Lime to disband its subcommittee which was dealing with plastering.

New Committee Work Planned

Steps have been taken to enter into a number of new lines of standardization work during the coming year. Petroleum Products are to be considered by the existing committee on Lubricants, whose scope has been correspondingly enlarged. The broad subject of metallography has been assigned to the former committee on Magnification Scales for Micrographs. Three new committees have been organized to study screen wire cloth, pyrometry, and heavy chemicals. Provision has been made to formulate and compile the technical nomenclature of the various subjects with which the society deals, and to frame definitions of the principal terms. A new start has been made in standardizing methods of testing, by a reorganization of the standing committee on this subject and by arranging for definite procedure of co-operation between this and the various committees on special materials.

Requests for the organization of a committee on standard specifications and tests for sand had been received, but the society decided that this subject could better be dealt with by means of conference of the several committees concerned with sand (such as those on lime, concrete, gypsum and road materials.

Technical Papers on Materials

While contributions on properties of materials were not of prominent importance at the present meeting, a fair amount of new data was presented. A note on relations between composition and structure of bronze, by William Campbell, was of exceptional scientific grade.

Data on other materials brought out included: Figures and plotted curves on the strength and ductility of molybdenum steel, with and without other alloying metals; figures on the variation of strength of malleable iron with size of piece and character of surface; fatigue data on aluminum alloys; proof-test figures on heavy power-forged ships' chains from the Boston Navy Yard; elaborate data on strength of plywood; studies of the relation between seamless and plied tubes in steam hose; examination of the so-called asphalt content in road oils and an investigation of the characteristics of steam-distilled petroleum residues.

Observations on Behavior of Materials

Discussing the internally-cracked condition of rails which has been the center of interest in the study of transverse fissures during the past two years, J. E. Howard gave the results of recent investigations made in connection with a bad train wreck, and explained the internal cracks as being the result of shrinkage after hot-sawing. Active discussion developed, in which, however, the steelmakers' representatives took no part. Stresses induced by cold rolling of metals were studied by H. M. Howe and E. C. Groesbeck by rolling two superimposed strips and measuring the resulting curvature. The report of these results was traversed by R. W. Woodward, W. R. Webster and W. C. Templin, the first-named demonstrating that two thin strips and one thick one behave differently in cold rolling.

Concrete behavior was the subject of four papers which will bear future abstracting. These included a study of stress-deformation and modulus of elasticity by G. M. Williams (U. S. Bureau of Standards), a report on the effect of hydrated lime on the strength of concrete by D. A. Abrams (Lewis Institute), a further discussion of the benefits of rodding concrete by F. E. Giesecke (University of Texas) and report on a newly discovered relation between the surface-area and the bulking of sand by Messrs. Young and Walcott of the Hydro-Electric Power Commission of Ontario. The first two received a great deal of discussion, largely in opposition to the conclusions of the authors.

Testing Instruments and Methods

More than usual time this year was given to the description and discussion of new types of testing machines. These include a ductility machine which weighs the pressure required to produce cupping in sheet metal; a high-speed alternating torsion tester, which utilizes the inertia principle; an automatic elastic limit recorder of the punch type; an instrument for measuring the hiding power of paints; a colorimeter for white pigments; a development of the plastometer to measure plasticity; an automatic cement tension tester which substitutes a liquid under pressure for the usual shot pressure recording; and an apparatus for extremely delicate flexure tests.

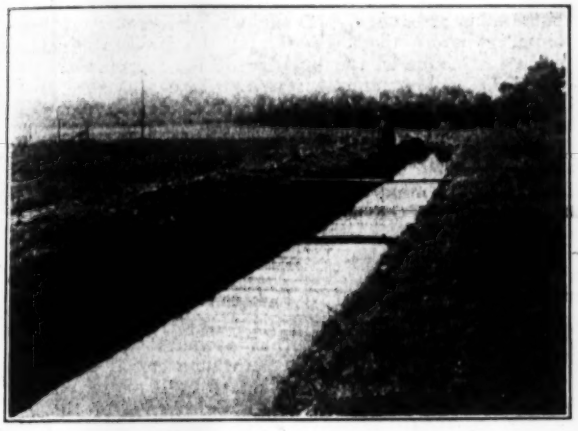
Several new test methods were also described, among them a method of determining the weight of zinc coating on a galvanized finished (shaped) article; a porosity test for electrical porcelain, using fuchsine; and an impact-wear test for road concrete. Studies of the accuracy of the Deval abrasion test for rock were reported.

Lining Irrigation Canals with Concrete Without Forms

Permanent Concrete Mortar Lining Economically and Quickly Placed on Canals in Southern California

By Francis Cuttle
President, Riverside Water Co., Riverside, Cal.

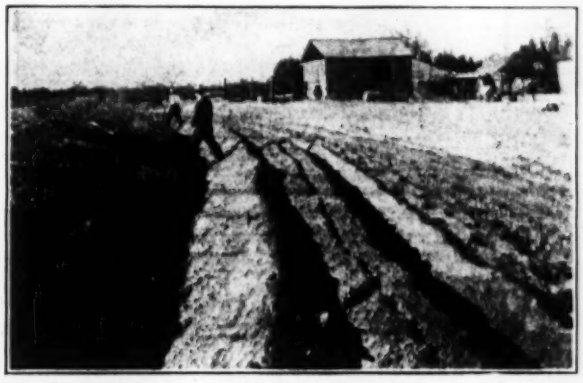
CONCRETE lining for irrigation canals to prevent loss by seepage, erosion of the bank, and growth of vegetation is a measure which on account of the heavy expense is generally impossible when the concrete has to be placed in forms. On the lines of the Riverside Water Co., at Riverside, Cal., however, for many years, a plaster concrete mortar lining has been placed with economy and with succeeding low maintenance. The practice of placing the concrete has been so developed that at the present time it is carried on



OLD UNLINED IRRIGATION CANAL

very rapidly as a routine part of the maintenance of the system.

It is obvious that a concrete lining 4 or 6 in. thick of good mortar cast between forms will prevent seepage, erosion of bank, and will eliminate the growth of vegetation; but this is so expensive as to be often prohibitive, particularly in localities where irrigation systems are just beginning and where there have not as yet been any returns from the lands. Twenty-six years ago this condition led the Riverside Water Co. to line a section of one of its canals five miles in length with a cement-mortar plaster ¾-in. thick. This canal is 12 ft. wide on the bottom and 4 ft. deep. It has been subjected to the severe test of having little water in it during the long, dry summers by reason of the fact that it is at the tail end of the system, and being taxed to its utmost carrying capacity during the rainy season; yet this canal today is in good working condition, and has required only trifling expense for repairs during the twenty-six years of its existence.



CANAL BEING PLOWED UNDER PREPARATORY TO PLACING LINING

More recently the company has been lining its canals with a cement-mortar coating 2 in. thick plastered directly to the prepared bank of the canal without the use of forms. Eight miles of such a canal lining were built in 1914 on the line of an old earthen canal of the company that had been in use for forty years. This canal has been in use for nearly six years and has given perfect satisfaction.

It is the present practice of the company to apply this 2-in. lining to most of its canal revisions. A concrete consisting of one part cement, three of sand, and five of stone passing a 1½-in. screen is used.

A special method of preparing the bank is now in use. First the banks of the old canal are plowed in with a tractor plow and the loose dirt puddled with water. The banks of the new canal are then brought to grade and alignment, the canal being narrowed from 12 ft. on the bottom to about 30 in. on the bottom and the depth increased from 30 in. to about 4 ft. The slope of the sides is about ½ ft. to each foot vertical. After the plowed and puddled canal has been excavated roughly to the shape desired iron rods are driven from the top of the bank to the bottom of the slope desired for the finished earthen bank. These rods are driven about 3 ft. apart and are used as the guides on which

PLACING THE CONCRETE MORTAR LINING

CUTTING SLOPES WITH VERTICAL KNIFE

a large heavy knife is screeded to slice the earth into a smooth bank of the desired slope and alignment. This knife is somewhat over 3 ft. in length and is pushed down the slide slope from the top to cut the earth as required.

The sand and crushed rock are disposed in piles about 100 ft. apart along the canal and a concrete mixer mounted on wheels is moved from pile to pile. The material is wheeled from the mixer to the point where work is being done, and shoveled from wheelbarrows directly on the canal bank. Water for mixing the concrete and spraying the banks both before and after the concrete or plastered lining is applied is furnished by laying a pipe along the line of the canal, water being pumped by gasoline engines.

The concrete is dumped over the side of the bank as a fairly stiff mix. A stick 2 in. thick is placed on the prepared bank 3 ft. away from the completed or rather just laid green concrete. A straight edge is then laid from this stick to the surface of the green mortar at the bottom of the canal and is in the hands of two men. Concrete is then shoveled onto this straight edge, which is brought up to the top of the canal filling a section 3 ft. length with the green concrete. The stick is then moved farther along the earth bank and the process repeated. This leaves the concrete in a rough form to be finished with a wooden float.

If the mortar is mixed to a proper consistency, the banks of the canal wet enough but not too wet, and applied in the manner above outlined the mortar will stick to a bank not exceeding 8¾ in. to 1 ft. slope; if it is very wet it will slide down, and in the hands of inexperienced men there may be difficulty in this respect, although with a proper mixture applied in the above manner little difficulty in placing the lining has been experienced.

Very rapid progress has been made in linings of this sort. The old plaster lining was put in, according to the records, at about 1,000 lin.ft. per day. The new 2-in. thick lining can be built at the rate of 100 ft. per hour with a gang of men about as shown in one of the accompanying views.

Common Sense and Engineering

BY J. E. ALDRED

Mr. Aldred, who has been the moving spirit in a number of the greatest power developments in the United States and Canada, has established at Johns Hopkins University a series of lectures on engineering subjects. The current series he opened himself with an "Introductory Address." The following paragraphs from that address give some rather frank views of engineers and engineering by one who represents capital and managing direction rather than the engineering details of design, construction or maintenance.

I am to say something about the common sense in engineering. When we say "common sense," we mean the application of those fundamental elements of judgment which have, through usage, come under the homely term "common sense." It is more difficult to define than to illustrate. As applied to engineering, it may have no relation to engineering as such, but it may be of great importance as related to the application of engineering to a problem. It is an element which is of importance in the training of students of engineering because, if kept constantly before them, it will, in the process of time, become instinctive in the practice of their profession. It is difficult to overestimate its importance, because it is something which may be passed on through an organization, and it may have a strong influence on the personnel of that organization.

It has been my thought that I might best present to you what is in my mind if I attempted to take you with me through some of the personal experiences I have had in connection with engineering matters, beginning about twenty years ago, when I took up the first large project which brought me in close contact with engineers and engineering problems. This took the form of a development carried out by the Shawinigan Water and Power Co. in Canada. When I found that I was to take up this enterprise, I thought it well to see what work of this character was being carried out at Niagara Falls and elsewhere. When I went to Niagara Falls and looked over the two large plants there—one having been built by the Niagara Power Co. and the other by a company under the name of the Niagara Falls Hydraulic Power and Manufacturing Co.—I was at once impressed by the difference between these two enterprises.

A COMPARISON OF TWO PLANTS

The plant of the Niagara Power Co. had been carried out by the engineers and designers with the effort to make this a show plant; the beautiful powerhouse was designed by no less celebrated architects than McKim, Mead & White. The grounds about the station looked almost like a park, and in the center of the plot, facing the power station, was a beautiful bronze flagstaff. The development indicated that an expensive upkeep would be necessary. The water was brought in from the river in a canal of comparatively small capacity, conveyed to the water-wheels which stood at the bottom of deep pits which had been cut through the solid rock. The water, discharging from these wheels at something like 150 ft. below the surface of the earth, was carried under the city of Niagara Falls in a tunnel which served as a tailrace, and by means of which the water was discharged into the Niagara River below the Falls. Everything about this enterprise indicated a lavish expenditure and a disregard of economy.

The plant of the Niagara Falls Hydraulic Power and Manufacturing Co. showed, in every respect, the opposite inclination. The water was carried in a canal on the surface of the earth to the edge of a cliff, where it was taken from a collecting basin by means of penstocks over the side of the cliff and down to the bank of the river, where powerhouses were built. Here were installed the water-wheels and generators, and the water, after passing through the wheels, simply spilled into the river at the lower level.

The impression made upon me as the result of examining these plants was that the engineer who had carried out the latter development had shown great economy and common sense in the general way in which he had met the requirements. I inquired as to who was responsible for the plant, and met Wallace Johnson, who had carried out the plans. The result of my visit was that when we were ready to go on with our work at Shawinigan Falls I called Mr. Johnson from Niagara Falls to take up the work in Canada; and that decision I never regretted. In all of the work carried out by Mr. Johnson there was constantly in evidence the desire to simplify problems and to apply sound reasoning and sense to the carrying out of every part of the work.

Now, to show how important this is—what a far-reaching influence a man may have on his associates. With Mr. Johnson there came to Canada from Niagara Falls two young men who quickly attracted my attention by reason of the fact that they, too, showed in their work an appreciation of the desirability of simplifying problems and applying to those problems calm and sane reasoning. It is enough to say that one of those men is now the head of the Engineering Department of the Pennsylvania Water and Power Co. and the other is the general manager of the Shawinigan Water and Power Co. in Canada.

Mind you, I do not for a moment mean to convey the impression that these qualities which we designate as "common sense" and "reason" will stand alone. They must necessarily be accompanied by technical training and the brain and ability, without which no man may rise to a dominating position in his profession. But the value of association of those men with that first man who was picked out among engineers as a man who more nearly answered the description of a safe and sane man, of sound judgment and common sense, has been of inestimable value to the men I have mentioned.

$1,000,000 Was Saved

The next large development in Canada with which I was associated was the development of Cedars Rapids, in the St. Lawrence River, and this furnishes a good example of how common sense and reason applies to a large undertaking. The Cedars Rapids development consisted of turning one section of the river bank into a huge canal which, skirting the rapids at this point in the river, gives at the lower end of the canal, under a head of about 30 ft., a large volume of water. When we came to the construction of this project we found it difficult to get contractors to make a reasonable bid for the work by reason of the fact that a good deal of the ground they would require to operate on was under water. After calling in some of the principal concerns in the country we decided that it would be advisable to carry out this work ourselves. We laid out the plant and uncovered the area, exposing the bottom of the river, and after we had put the thing in shape so that everything was visible to the naked eye, we brought in a contracting firm in whom we had confidence to do the work.

It is enough to tell you that this method of carrying out this work resulted in a saving of over a million dollars, as against the best price we had from any contracting concern in the country. After we had worked on the Cedars Rapids for a year and a half, we saw signs of distress on the part of the contractors. They were working on the basis of so much a yard for earth, rock and concrete. They were good men and competent, and we went to them and asked them how they were getting on. And they finally confessed that it looked as if they would have two years' work for nothing. This was not a desirable situation. We had a year's work ahead of us to finish this plant and to put it in operation to meet the requirements of the city of Montreal. I said: "We will put an auditor on your books, and if your statement is correct we will make a new arrangement with you." We very quickly ascertained that they had told us the truth, so I worked out a proposition whereby they would be assured a profit of $150,000. We then said: "Now, go ahead with the work; keep the prices that you have been working under and see what you can do in the end. If you make any saving over and above the $150,000 that we are giving you as a profit we will divide it with you.".

They worked up to such a degree of speed and efficiency—and they were employing between two and three thousand men—that during the next year it was perfectly wonderful to see the work go on. The net result was they not only saved the $150,000 that we agreed to give them as a profit, but they saved $75,000 additional, which we divided with them. In other words, the common sense policy applied to this undertaking cost us not one cent, but it resulted in a saving to us and the contractors' making $187,500.

I well remember when I first heard of the work which was to be carried on in the development of power on the Susquehanna River. A friend of mine told me of a visit he had made to the work and described the manner in which it was being carried on. He was familiar with the economical system we employed in our work in Canada, and he was setting up this Susquehanna River work as a sample of the opposite kind of management. After he had described the undertaking and the character of its plans for the carrying out of the work, I said: "Well, we may have an opportunity of taking it over some day." I little realized at the time the seriousness of that statement, but three years later I was appointed receiver for the company. I brought down and put in charge of the completion of this work—the plant was about 50 per cent completed—one of the young men I previously referred to as having come to Canada with Mr. Johnson, and he carried out this huge undertaking—in sole charge of the engineering work—with the net result that the completed plant was at least 25 per cent better than it would have been in accordance with the original plans, and at a cost of something over a million dollars less than the amount which we had provided for him to do the work.

How Foolish Engineers Can Be

To illustrate how foolish engineers can be, I will tell you of one detail in connection with this plant on the Susquehanna River. We found, according to the original plans, that provision was made that the transformer house should stand on a bridge and that the cooling coils for the transformers should be submerged in the tail-race (this was a water-saving device), under the arches of this bridge. Well, as you know, these cooling coils have hundreds of joints, any one of which is liable to leak, and the only way to get at these cooling coils to make a repair was by putting on a diver's suit and going down under the bridge. The absurdity of such a scheme must be evident to anyone, yet this was a scheme devised by one of the well-known engineers in this country.

Now, a word as to the penalty for not applying reason and sense to engineering undertakings. In considering this, please keep in mind that a substantial percentage of the great engineering works undertaken are initial failures. I suppose you hardly realize that, but I know it to be true from a survey made of the principal engineering undertakings in this country and outside, and if it were necessary—but I think it would be inadvisable—I could give you a list of thousands of huge engineering undertakings in this country that have been substantial failures.

Personally I have seen hundreds of reports on water-power projects, but I have never yet seen an unfavorable report. So far as I am personally concerned, there is no such thing. To consider the seriousness of this, I will give you a specific instance that I know of about a company (which shall be nameless) which carried out a large water-power development on this continent on the strength of a report by one of the three or four best-known engineering concerns in America. That enterprise involved an initial expenditure of over seven million dollars. The report set forth that the company could develop an initial 100,000-hp. capacity, and eventually could develop as much as 400,000-hp. capacity. The company has been in operation for ten years now and it has never in any one year developed 20,000-hp. capacity. What about it? Here is a report of a reputable (supposedly), well-known, eminent engineering concern, on the strength of which report people made an investment

of millions of dollars. Lost! And any man with sound common sense and any knowledge of the business could have said right at the start that it would be lost.

What does it mean? It means that a lot of lads sitting in a drafting room down in New York designed, subject to a report which they had from some of their superiors, I suppose, a plan to generate electricity by means of water-power under conditions with which they were unfamiliar. They had only surface knowledge, but they wanted to do a job. Engineers always want to do a job of work. They never turn down a job; but what is the net result? The loss of millions of dollars in the course of a work that would do an indefinite amount of harm to other similar enterprises that may be suggested for years to come.

I urge the necessity of bringing to bear upon the student of engineering the influences that will tend to make him more practical and constantly have in mind that an engineering project must check up, not only from the standpoint of the technical and the desirable, but from the standpoint of the reasonable and the desirable, and that the student must cultivate this habit of considering his work from the standpoint of "common sense."

Locating an Underground Water Supply by Water Worn Gravel Clues

By F. S. Tainter
Consulting Engineer, 60 Wall Street, New York City

DEPOSITS of a peculiar gravel found in a deep test trench was the clue successfully followed by the writer in locating an ample source of water supply for the Government Proving Ground at Aberdeen, Md., in 1917, after it had become evident that neither surface or shallow underground water of sufficient quality and quantity were available. This gravel was composed of conglomerate quartz combined with hard slate of varying colors, all much water worn.

Similar gravel was found at a depth of 80 ft. at a well being sunk at another point. Inquiries disclosed the fact that the same gravel had been encountered at a well previously sunk on the reservation. A range was then established, a profile showing surface and known sub-surface conditions was drawn and another well ordered sunk. All existing maps were studied and the gravel already mentioned was compared with samples from various points beneath the bed of the Susquehanna River. The writer also recollected that while building a dam across the New York fork of the Susquehanna River at Colliers, N. Y., 22 miles distant, he had encountered a similar gravel.

Reasoning from the data thus accumulated, a hypothetical line some two miles long was staked out and nine wells sunk along it. At an average depth of 140 ft., in beds of coarse sand and the Susquehanna gravel, these wells yielded some 300 gal. per minute each, but two other test wells, sunk only 125 ft. to the right and to the left of the line, produced less than 40 gal. The water was potable, and required no softening for boiler-feed use.

A careful revisional study of the entire development, supplemented by color tests upon the wells themselves, confirmed the writer in believing that the locations were along the channel of an old Susquehanna delta. At a point some 4½ miles upstream from Havre de Grâce is a rock barrier, on which lies a sand and gravel bottom capable of filtering through to any existing subterranean channels a practically inexhaustible supply of water, which, led gradually to lower levels between two heavy strata of clay, makes its way to the sea under pressure through ancient water courses.

Concrete Base Repaired With Precast Slabs

Patches in Good Condition After Five Years' Use—Method Considered Practicable in Original Construction

By Charles B. Dugan
Engineer, National Steel Fabric Co., Chicago

AN EXPERIENCE in precasting concrete slabs for repairing pavement base, although it is old, is of interest in view of the plan now being considered by the Wyoming highway department for constructing a concrete road of precast slabs. With this experience as evidence, it is believed that precast slab construction is entitled to consideration where local conditions make especially difficult the ordinary methods of molding the pavement in place, or where the last possible interruption of traffic is demanded.

CAST SLABS LAID AND JOINTS FILLED

Due to improper curing and, more especially to the faulty grading of aggregates, numerous failures occurred in widely scattered spots over some 45 mi. of concrete pavement laid under the direction of the California Highway Commission, during the years 1913 and 1914 and on a trunk route, where the original traffic was more than tripled by the attraction of the improved highway. This particular stretch of pavement was laid without expansion joints and the failures occurred generally in the middle of the pavement and immediately adjacent to transverse contraction cracks. Mechanical tests for abrasion, and observation of the extent of ravel at these weaknesses, very closely defined the ultimate dimensions of the failure and after a careful analysis of the extent and cost of replacements, the author conceived the idea of precasting concrete inlays at a central maintenance yard, where the mixing and curing could be effected more thoroughly and with much greater economy, due to the reduced overhead cost and the concentration of labor into a single, efficient gang.

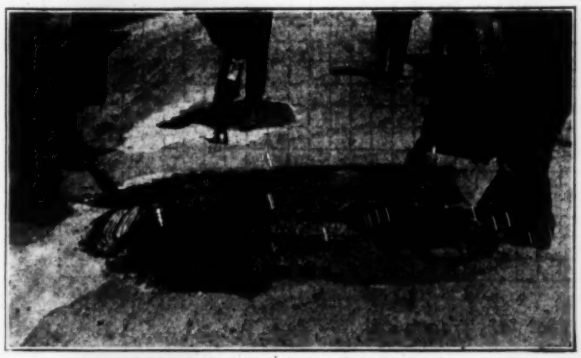
At first the slabs were cast in an irregular trapezoidal shape to fit best the needs of an individual replacement. This plan was quickly abandoned in favor of a uniform size inlay, 18 x 36 in., and 25 per cent greater in thickness than the original pavement. The larger, irregular shaped slabs had the disadvantage of being awkward to handle and of requiring special forms. They also had to be marked with station numbers and loaded in numerical order to insure delivery to their particular locations on the work.

POURING AND SPREADING ASPHALTIC OIL

The stock size of inlay permitted of a standard form, which was developed with a flat bottom and with hinged sides, kept in position by ordinary hasps. The lumber used was all surfaced and tightly joined, and was rubbed down with crude oil on the inner faces of the form previous to being put in use. Excellent results were obtained in a clean-cut, close-grained product and in a long life for the forms. Loops of No. 4 soft iron wire were cast into the slabs toward each end and allowed to project about 4 in. The inlays were dyked and kept under water for two weeks, and, after drying out for an additional ten days, were lifted by means of a 2-in. pipe slipped through the wire loops, and loaded into a 5-ton truck. Abrasion during transit was avoided by using 1 x 4-in. strips for separation.

These slabs were delivered in estimated numbers alongside of the concrete to be replaced. The opening in the concrete was cut out to eliminate all chalky material and was then trimmed back to a vertical face to accept the necessary number of inlays. The subgrade was reduced to permit of placing the inlays flush to grade, and, if spongy, it was excavated and backfilled with graded rock compacted to a maximum degree by heavy tampers. A 1-in. sand cushion completed the foundation. Painting the sides of each block just before it was finally seated insured the best possible bond and a thorough penetration when the mastic filler was poured into the joints upon completion of the repair. The wire loops served as a means of raising and lowering the blocks to eliminate any unevenness in the sand cushion and to bring the surface to a straight-edge grade. They were cut off flush when their purpose had been served.

The accompanying illustrations show a single installation of four inlays with the mastic filler poured. They also indicate the method of replacing the ⅛-in. asphaltic oil cushion with which this particular section of pavement was covered.



COVERING ASPHALTIC OIL WITH SCREENINGS

This method of repair was put in operation in the fall of 1914 and during the season of 1915, and recent inquiries about the condition of the work indicate its success.

Free Engineering Advice

Speaking on "Some Problems of the Practising Engineer," before the Oregon Chapter of the American Association of Engineers, John W. Cunningham, of Barr & Cunningham, engineers, of Portland, made the following comment on the giving of "free" engineering advice:

Engineers have from time to time, registered a complaint against the giving of "free" engineering advice by governmental departments and notably by departments of the colleges and universities. Actuated by a commendable but misdirected idea of public service, these departments have gradually extended their functions until they cut in appreciably on the opportunities for the engineer in private practice. The United States Department of Agriculture and the associated state extension departments have been particular offenders in this respect. Originally they were intended to help the farmer in his chicken raising, fertilization, control of pests, and similar problems. Now they prepare complete engineering reports on drainage, irrigation and power development, and teach the farmer to lay the grades for his ditches, select and install his pumps and electric plants and design his bridges, and buildings, everything free for the asking.

The writer sees no objection to college and university professors undertaking outside engineering work in their spare time. They should, however, charge for it in proportion to their experience and the responsibility assumed. Such work is both legitimate and desirable to broaden the practical experience of engineering teachers and is only detrimental to practicing engineers when services are given without charge or fee or for a disproportionately low fee.

Free engineering advice by manufacturers and material men should be opposed most strenuously by professional engineers. The field of the practising mechanical and electrical engineers is especially affected by the activities of the machinery manufacturers and their agents. The pump salesman tells the intending purchaser, "You don't need an engineer; just fill out this blank and we will tell you what machine to select and how to install it." The back pages of catalogs have become veritable text-books on engineering. The structural engineer must meet the competition of the free engineering advice by steel manufacturers and sellers of reinforcing metal.

The sad part of it all is that this "free" engineering advice is never in reality free. Where by public departments, it benefits a few at the expense of the general taxpayer. Where it comes from manufacturers or their agents, it enters inevitably into the price paid for the commodity. Free services are usually casual and free advice is poor counsel, and really most costly. The camouflage should be exposed, and those bodies which are supposed to represent engineers should stamp such activities as unprofessional.

Unfair Competition

A form of competition quite difficult for the practising engineer to meet is that of the man entirely competent in his line and regularly employed on a salary, who takes occasional outside jobs for evening or extra work. The right to undertake such work cannot be disputed, but the man who uses this right should not by a reduction of legitimate fees, injure the practice of that other engineer, who has office rent, stenographic services, and other overhead charges to consider before he can count his actual profits.—*John W. Cunningham in a paper before the Oregon Chapter, A. A. E.*

Method of Estimating Sewer Construction Costs

Diagrams Based on Average Gang Performance—Costs Tabulated for Quick Reference—Typical Gangs and Average Machine Outputs

By George C. D. Lenth
Assistant Chief Engineer, Sewer Division, Chicago

During the past year, when prices and wages have varied from week to week, it has been necessary continually to revise estimates for sewer construction. To expedite this task various short cut methods have been successfully employed. Their use is particularly advantageous in making estimates for work which involves the use of excavating machines. Fundamental to these methods is a thorough knowledge of the average performance of gangs in accomplishing given tasks in a unit of time, usually a day. Such performance records, based on data collected over a long period, are presented. From them diagrams have been constructed and cost tables prepared which have a wide utility to engineers and contractors.

The shortage of labor makes it necessary to employ machinery wherever it is practicable. In many instances machinery must be used if the work is to be completed, even if the cost is as great as, or is greater than, hand work. The estimator, therefore, requires definite knowledge of the crew necessary for each operation and a reasonable knowledge of the performance of equipment.

Under the classification of endless-belt machines are included such trench excavators as the P. & H., the Austin, the Parsons, the Buckeye and the Bucyrus. Machine performance and construction crews average about as follows:

Excavator Crew—For steam-operated trench excavators the following crew is necessary: One foreman, one hoisting engineer, one fireman, one laborer supplying coal and water, two laborers loading the machine, one bracer, two laborers aiding the bracer, one bottom man grading ditch, and one watchman; making a crew of twelve. At the present time (May, 1920) the cost of operating a machine of this type in Chicago and vicinity is $120 per 8-hr. day, including the above crew, fuel, depreciation, repairs and interest on the investment. When the rate of progress of the machine is known or determined by experience, the unit cost of

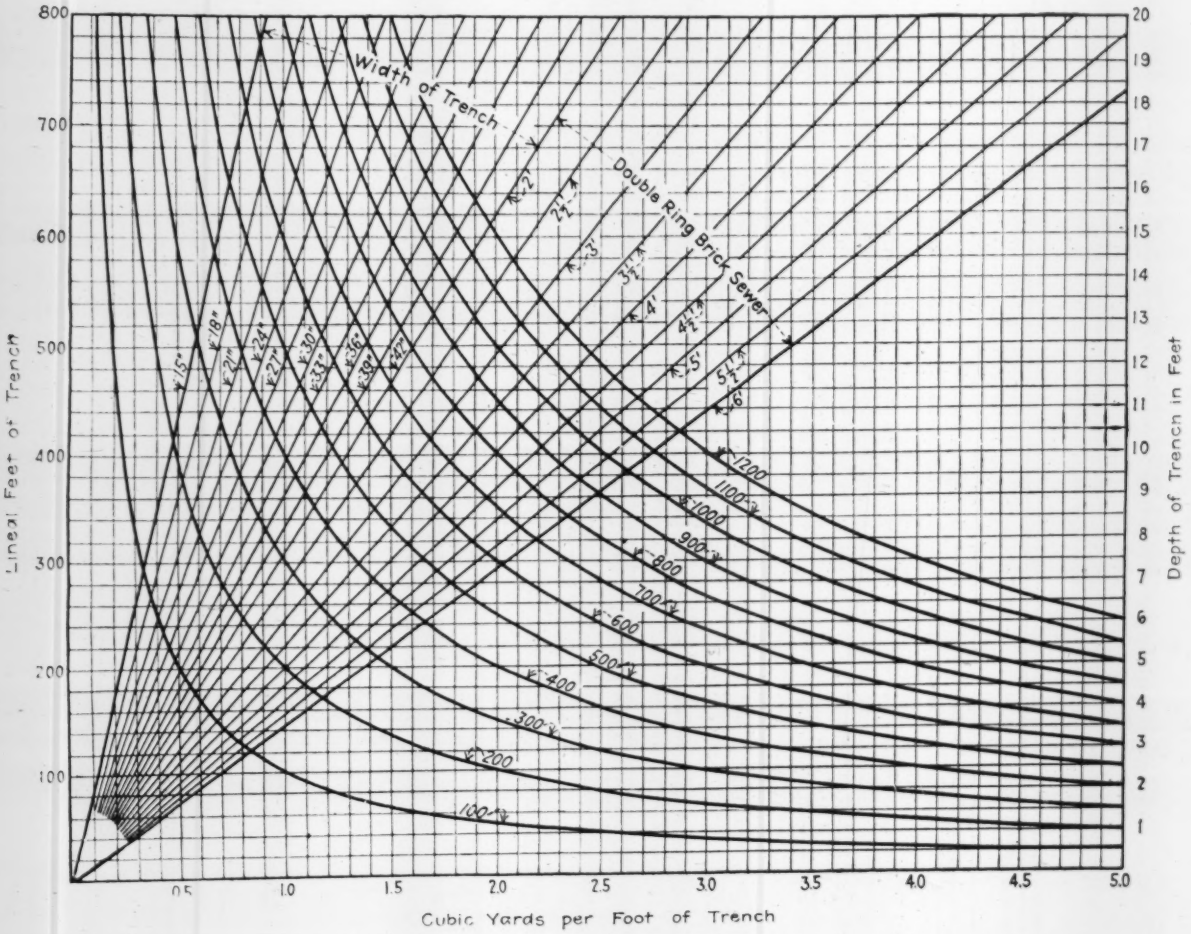


DIAGRAM 1—FOR ESTIMATING PROGRESS OF SEWER EXCAVATION WITH TRENCH EXCAVATORS

excavation and bracing, exclusive of timber, is readily obtained. In this connection the estimator should bear in mind that it is the daily average performance over a period of weeks or even months that must be used in order to be safe. Manufacturers often overstate, or give maximum rates of the output, of their equipment, rather than the average rates.

In the glacial clays of northern Illinois and southern Wisconsin the average rate of excavation per hour, under good condition, is as follows: Depth of excavation less than 8 ft., from 50 to 60 cu.yd.; depth of excavation less than 12 ft., from 40 to 50 cu.yd.; depth of excavation less than 16 ft., from 25 to 35 cu.yd.

Pipelaying Crew—The force ordinarily necessary to lay tile pipe, following an excavating machine, is as follows: One mason, one tender, one laborer lowering pipe, one cement mixer and carrier and four laborers covering sewer pipe and removing sheeting and braces. The cost of pipe laying, exclusive of materials, is $68 per 8-hr. day. The unit cost of pipe laying can be readily determined when the rate of progress of the excavating machine is fixed.

Manhole Crew—The force ordinarily needed to build the manholes, catchbasins, etc., is as follows: One mason, one tender to mason, two laborers and one cement mixer and carrier. The cost of bricklaying on manholes and catchbasins is $44 per 8-hr. day for 4,000 bricks laid, or $11 per thousand of brick.

Backfilling Crew—The force used in backfilling the sewer trench is generally one hoisting engineer and two laborers. The cost of backfilling is $30 per 8-hr. day, including the above crew, fuel, depreciation, repairs and interest on the investment. If it be assumed that a No. 10 Parsons or a small Austin backfiller, on a 300-cu.yd. basis, is used, the unit cost per yard is 10c.

Mason Crew—If the sewer is to be constructed of brick of an internal diameter varying from 2½ ft. to 4½ ft., the force needed is as follows: Two masons, one tender to masons, one cement mixer and carrier, two brick tossers, one brick wheeler and one form setter. The cost of bricklaying is 80 per 8-hr. day, and the cost of laying a thousand brick will vary from $24 on a 2½-ft. double-ring brick sewer to $19 on a 4½-ft., double-ring brick sewer.

When sewers or conduits are to be constructed in trenches whose outside dimension exceeds 78 in., machines of the shovel type, such as steam shovels, dragline excavators and keystone excavators are employed for the excavation. The shovel spans the trench excavated, and is carried on suitable timbers properly braced. It is moved on rollers with the aid of the hoisting engine on the shovel and a cable and dead-man ahead. The rate of progress varies from 60 to 100 cu.yd. per hour, with an average performance of 70 cu.yd. in good soil.

The force necessary on steam shovels is as follows: One foreman, one engineer, one cranesman, one fireman, four bracers, four tenders and bracers, two bottom men trimming ditch, one laborer for supplying coal, water, etc., and one watchman. The cost of operating a steam shovel in Chicago and vicinity is $200 per 8-hr. day, due allowance being made for fuel, depreciation, repairs and interest on the investment.

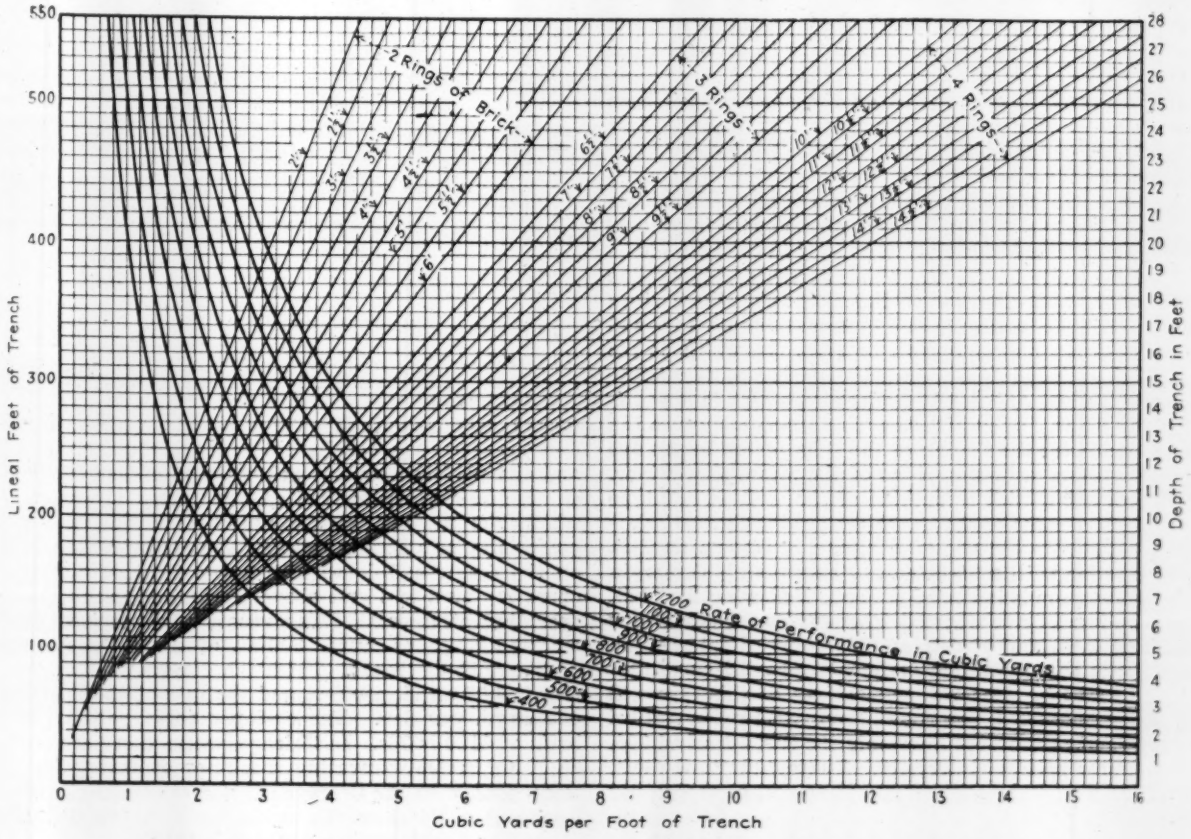


DIAGRAM 2—FOR ESTIMATING PROGRESS OF SEWER EXCAVATION WITH STEAM SHOVELS

In the above units the rate of wages of sewer bricklayers is $1.50 per hour, and the average rate of wages for sewer laborers is $1 per hour.

Unit costs having been established, Diagrams 1 and 2 illustrate the methods of establishing the progress per day. This progress is controlled by the speed of the excavating machine; after this has been determined the organization of the construction forces can be planned.

On Diagram 1 for machines of the endless belt type, the depth of cut is plotted along the right margin; the diagonal lines marked 15 in. to 42 in. are the widths of trench dug by machines of this type, and the diagonal lines marked 2 ft. to 6 ft. are the widths of trench necessary for double-ring brick sewers of the respective internal diameters; the curves marked 100 to 1,200 indicate the rate of yardage per day; the cubic yards per foot of trench are plotted along the lower margin and the lineal feet of trench excavated are plotted along the left margin.

Use of Diagrams

To illustrate the use of Diagram 1, assume a 24-in. tile pipe sewer with a 12-ft. cut. The width of trench to be dug in this case will be 36 in. Along the right margin of the diagram is indicated the cut or depth of excavation. Following the 12-ft. line horizontally to where it intercepts the diagonal line marked 36 in., and projecting this point of intersection vertically, the excavation is found to be 1.35 cu.yd. per foot of trench. Excavating machines of this type will average 300 cu.yd. per day in a 12-ft. cut. From where the vertical line 1.35 cu.yd. per foot intercepts the curve marked 300, project the point of intersection horizontally to the left and the rate of progress found is 230 ft. of trench per 8-hr. day.

Diagram 2 is constructed on the same principle as Diagram 1. The group of diagonal lines marked 10 ft. to 14½ ft. (internal diameter) are the widths of trench necessary for circular brick sewers having four rings of brick laid edgewise, making the total width of the trench at the springing line approximately 2½ ft. greater than the internal diameter. Similarly in the group indicated 6½ ft. to 9½ ft., the width at the springing line is the internal diameter of the sewer plus three rings of brick laid edgewise, which is approximately 2 ft., and in the group indicated 2 ft. to 6 ft., the width at the springing line, is the internal diameter of the sewer plus two rings of brick laid edgewise, which is approximately 1.5 ft. In constructing this chart, allowance has been made for the sloping of the sides of the trench due to excavating with a machine of the steam shovel type. In excavating with a machine of the endless belt type the walls or sides of the trench are practically vertical.

To illustrate the use of Diagram 2, assume an 8-ft. brick sewer with a 20-ft. cut. Along the right margin of the diagram is indicated the cut. Following the 20-ft. line horizontally to where it intercepts the diagonal line marked 8 ft. and projecting this point of intersection vertically the excavation is found to be 7.6 cu.yd. per foot of trench. Excavating machines of this type will average 800 cu.yd. per day. From where the vertical line 7.6 cu.yd. per foot intercepts the curve marked 800, project the point of intersection horizontally to the left, and the rate of progress found is 105 ft. of trench per 8-hr. day.

With the above unit costs and the foregoing explanation of the use of Diagrams 1 and 2, the contractor is in a position to use the cost computation form shown. This form is valuable because it enumerates most of the items affecting the cost of work. A list of this kind often prevents the omission of important items.

The first twelve items constitute the basic information needed for the making of an estimate, the money items of which are numbered from 12 to 36. Items 1, 2 and 12 are the known data; items 3 and 11 are obtained from Diagrams 1 and 2; item 4 is the actual sewer displacement of the finished construction; item 5 is the difference between item 4 and item 3, which is the amount of the backfilling; item 6 is obtained by computation or from a table of quantities; items 7 and 8 are self-explanatory; item 9 is the feet of hand excavation required to be done, such as the hand excavation at the start of the job, adjacent to sewers intercepted, etc.; item 10 is to indicate the number of times the machinery must be taken down and the cost of this entered in one of the blank spaces as 32.

Diagrams 1 and 2 have other uses. The writer has used them quite successfully as a superintendent in charge of construction work on sewer and water systems. Daily reports were received of the average cut

(1)	Diameter (internal horizontal)		
(2)	Depth of cut in feet		
(3)	Total yardage		
(4)	Surplus yardage		
(5)	Net yardage		
(6)	Masonry per foot		
(7)	Cost per unit—material		
(8)	Cost per unit—placing		
(9)	Feet of hand excavation		
(10)	Subways, elevated roads, etc		
(11)	Rate of progress		
(12)	Length		
(13)	Excavation—hand		
(14)	Excavation—machine		
(15)	Excavation—surplus		
(16)	Backfilling		
(17)	Removal of pavements		
(18)	Sheeting and bracing		
(19)	Pumping		
(20)	Materials		
(21)	Cost of placing		
(22)	Forms—square feet		
(23)	Steel—pounds		
(24)	Reconnection of house drains		
(25)	Reconnection of sewers		
(26)	Reconnection of catchbasins		
(27)	Reconnection of service pipes		
(28)	Water mains		
(29)	Gas mains		
(30)	Conduits		
(31)	Car tracks		
(32)			
(33)			
(34)	Insurance		
(35)	Overhead, profit, etc		
(36)	Total		

Use for estimate.

COST COMPUTATION FORM FOR SEWER CONSTRUCTION

and the performance of each type of excavating machine, and a ready method was necessary to ascertain whether or not the particular machine in question was performing at a loss or a profit. A base curve was used on the diagram, below which curve the machine was operating at a loss and above which the machine was operating at a profit. The report was received that machine No. 1 excavated 300 ft. of trench 12 ft. cut, 42-in. width of trench. From the diagram the excavation is 1.55 cu.yd. per foot and the rate of the machine 460 cu.yd. per day. The cost per cubic yard on the basis of $120 is 26c. In Chicago, where there are from eight to twelve excavating machines operating on as many jobs, with the average cut and other data known, by means of the chart the writer has thus kept records of cost and performance for each machine.

Electrolytic Sewage Treatment

A Half Century of Invention and Promotion

By Robert Hall Craig,
Sanitary Engineer for Water Supply, Construction Division of the Army, Washington, D. C.

FIFTY years ago C. F. Kirkham, in British patent 2,653 (dated 1870) proposed a filtration process for sewage treatment but suggested: "That on its way to the filters the liquid should pass through a receptacle in which are a number of zinc and copper plates by which arrangement a continuous current of electricity is made to pass through the sewage water and will materially aid in freeing it from its manurial properties." From that time until this, as the following review shows, inventors have busied themselves with attempts to perfect an electrolytic process of sewage treatment, generally by direct action on the sewage but in several cases by the production of hypochlorites from a solution of common salt, the hypochlorites to be added immediately to the sewage being treated.

In 1873, F. H. Atkins (British Patent 556) proposed to "apply galvanic action, magnetic action, or electrical action to filtering apparatus, reservoirs or tanks for the purpose of precipitating organic matters or impurities held in suspension or solution in the water or other liquids." He arranged plates in the tanks and passed electric current through the liquid by using the plates as electrodes.

In 1874, E. H. C. Monckton (British Patent 265) proposed to use "electrified channels for purifying sewage or to drive ozonized water [ozonized it would seem by electrical action] into sewage." He likewise proposed to employ windmills to generate electricity which may be used for treating sewage.

Reviewing the subject in 1888, J. W. Slater, in his book on "Sewage Treatment, Purification and Sterilization" stated that "The action of the electric currents on polluted waters remains to be studied. Laboratory experiments hold out hopes but on a large scale they may prove costly." In a later chapter he states that "another agent recommended is electricity, generally in combination with other processes or agencies." From experiments on a small scale, the writer [Slater] is disposed to conclude that imperfect effluents from any kind of process might thus be brought to a high degree of purity. On the question of working costs it is difficult to decide but probably where there exists a fall of water, or other inexpensive means of turning a dynamo-electric machine, the process might be practicable."

In 1889, William Webster of England conducted experiments with his patented process in which he passed an electric current through the sewage, using iron or aluminum electrodes. He called attention to the oxidizing and precipitating effect of electrolysis and told of the probability of the production of hypochlorites.

Later Hermite of France developed the idea of the formation of hypochlorites from the electrolysis of salt solutions. At Ipswich, England, the Hermite process was used, where the liquid hypochlorite was run into the main sewer. This was abandoned in 1905 after about ten years operation because the results obtained were not commensurate with the cost.

In 1893, at Brewster, N. Y., the Woolf process of producing hypochlorites from a solution of common salt was applied on a small scale to sewage. Soon afterward a much larger Woolf plant was built at Danbury, Conn., but in 1895 the latter place was enjoined from discharging the effluent from this treatment plant into the Still River and filtration was adopted in its place. Practically the same process was used in Bombay in 1897, but abandoned after four months' trial, it being found that the same amount of free chlorine could be obtained from "chloride of lime," at one-half the cost. (Folwell's "Sewerage.")

Fuller, in his "Sewage Disposal" (1912), after mentioning the Webster, Hermite and Woolf processes, says "electrolytic treatment for the formation of hypochlorites is not sufficiently certain to recommend its regular use."

The Harris process of employing electricity was tested on the Passaic River water in 1893. The system was again tested by Fuller, in 1896, at Louisville, Ky., on the Ohio River water for the purpose of "coagulating and purifying the muddy Ohio River water." The conclusion reached at that time was that the process accomplished little along the lines of oxidation but that it did have merit as a means of coagulating the water preliminary to subsidence and filtration.

This Harris-magneto process was installed at Santa Monica, Cal., and was later modified to conform to patents taken out Aug. 2, 1910, by L. G. Lautzenhiser and C. P. Chandler, which patents were an improvement on the Webster process. Because of the rapid decomposition of the upper edge of the iron plates copper strips were placed on these edges and provisions made for reversing the electric current so that wear on plates would be even. It is this company's plants in Oklahoma which were described by J. A. Evans, Engineer State Department of Health of Oklahoma, in *Engineering News-Record*, Jan. 15, 1920, as being practically all shut down.

The writer did some experimental work for the Electro-Sanitation Co. of East Palestine, Ohio, in the winter of 1914-15 at New Brighton, Pa. The process used was that of the Lautzenhiser patents. Experiments were conducted on normal sanitary sewage after it had been allowed to flow through a two-story settling tank which gave a retention period of 1½ hours. The first set of experiments showed a treatment cost for electricity alone at the rate of 3c. per kw.-hr. of $6.58 and the second set of $4.16 per 1,000,000 gal. These costs do not include labor or deterioration of plates, interest on investment, etc., but merely cost of current.

The general conclusions drawn from the results of these tests and from those of Prof. Turley, J. E. Welke and others are as follows:

Advantages—(a) Average reduction total bacteri on nutrient agar at 37.5 deg. C., 82.2 per cent. (b) Average reduction of B. Coli, 92.2 per cent. (c) Produces ferric hydroxide which aids in coagulation, sedimentation and clarification of the treated sewage. (d) Liberates nascent oxygen which destroys bacteria and effects partial oxidation of the organic matter. (e) Requires low sewage head to operate, not more than a foot. (f) Resultant stability is fairly high. (g) Odors are not noticeable.

Limitations—(a) Must be preceded by unit, either fine screens, plain sedimentation or an Imhaff tank, which will remove the suspended matter in order to permit the electric machine to satisfactorily operate. If solid suspended matters go through the machine they will

receive only an external treatment. (b) Septic sewage cannot be run into the machine. (c) Production of ferric hydrate results in deterioration of iron plates, necessitating renewal of electrodes. (d) Requires careful and experienced operation with constant expert chemical and bacterial control. (e) Oxidation is not sufficient under regular operation.

The Landreth process, in which lime is used in conjunction with the electrolytic action, is described as having the following fundamentals: "(1) The production of nascent oxygen and hydrogen by the electrolysis of sewage previously rendered caustic, preferably with calcium hydroxide; the caustic inducing electrode passivity by the formation of an oxide film, and also acting as a precipitant. (2) Removal of the electrode accretions while producing nascent oxygen and hydrogen by electrolysis with electrodes rendered passive in the previous process followed by the addition of a caustic precipitation such as calcium hydroxide. (3) Alternate application of the above processes as occasion demands, to produce nascent oxygen and hydrogen and maintain the electrodes in a passive condition."

An experimental Landreth plant was operated at Elmhurst, L. I., in 1914. A test plant was installed at Decatur, Ill., to treat starch waste and gas plant and packing house wastes. An experimental plant was installed at Easton, Pa., in 1918. Phillipsburg, N. J., and Allentown, Pa., are installing plants of this type and should conclusively show the results of this combination of electrolysis with lime treatment.

The Bull process, in which an electrolytic cell with graphite electrodes is used to produce perchloride of iron by electrolysis of a salt solution and by passing through iron borings the chlorine and hydrochloric acid formed has not been developed commercially. Caustic soda is a byproduct.

It does not appear that the electrolytic processes will supplant the treatment of sewage by the natural biological processes, such as in septic tanks and filters.

Government Standardization in Building Field

If standard specifications could be prepared and agreed upon in a much larger number of cases than has yet been done, it would greatly facilitate the work of architects and builders. And if building methods and the requirements of city building codes could be thoroughly studied and revised this also would aid in reducing building costs. It seems probable that hundreds of millions of dollars could be saved within a few years if a comprehensive and intelligent study were made of all phases of building including fire prevention and the plumbing, heating, lighting, and hardware equipment of buildings. It would also reduce the cost of repairs and maintenance of these buildings; partly because deterioration would be slower and failure would be less frequent, and partly because repairs would be easier and cheaper to make. The government would do only a portion of this work of research and standardization, as many engineering societies, industrial organizations and manufacturers would co-operate. But the government should take the lead, and do an important part of the research work, and nothing which the government could do would be more useful and constructive or would be more appreciated by the building industries and the public.—From an address by E. B. Rosa, chief physicist, Bureau of Standards, on "The Economic Importance of the Scientific Work of the Government."

Experience with Precast Revetment Block on a Dam

Grouting Relaid Blocks with Long Joints Up and Down Slopes Effects Repairs Which Withstand Heaviest Storms

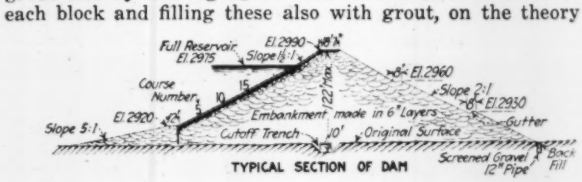
WIND velocities of 72 miles per hour accompanying the heaviest storms have been successfully withstood by the revetment of grouted precast concrete blocks on the slopes of the Belle Fourche dam of the U. S. Reclamation Service. The repairs which had to be made before a stable protection against wave action was obtained and which amounted to making the slopes an unbroken monolith by the grouting of the joints, are described in the May *Reclamation Record* by B. E. Hayden, project manager, Belle Fourche Project.

The revetment on the face of the dam as originally constructed consisted of concrete blocks 6½ ft. x 5 ft. and 8 in. deep, laid on the 2 to 1 slope, and blocks of the same size but 6 in. deep laid on the 1½ to 1 slope. At the bottom of the slope the revetment is supported by a footing of wooden piles and a concrete wall. A parapet wall 2 ft. high runs along the top of the revetment. The blocks were cast at the Snoma gravel pit 6½ miles away on the river bank and were transported to the dam on a narrow-gage railway built for that purpose. The foundation for the revetment consists of a 2-ft. layer of gravel, the top foot of which is screened and the lower foot pit run carrying an excess of sand. From about El. 2,977 to the top of the dam the bed is only 1 ft. thick and consists of screened gravel. Blocks were laid with close-fitting joints although not pointed. Horizontal joints were continuous; vertical joints were broken.

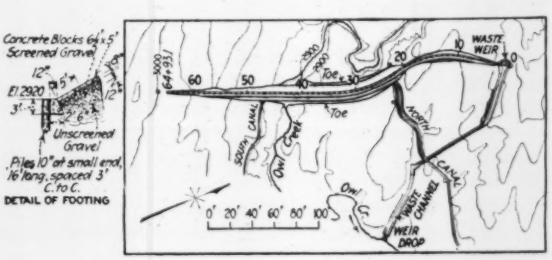
On April 14, 1912, a characteristic seasonal storm occurred, lasting for several hours, with what was estimated to be a 60-mi. wind from the northwest, driving squarely against the face of the dam. When the storm had subsided so that an examination could be made it was found that 230 blocks were dislodged and breaches made in the pavement at various points between stations 29 and 42. The water surface at the time of the storm stood at El. 2,959, or 16 ft. below capacity.

Briefly, the method of repair followed was to refill the breaches with gravel, relay the disturbed blocks 6 to 8 in. below grade, and finish with a continuous layer of concrete to grade. The concrete was reinforced and anchored to the blocks below.

It was decided that all blocks in the "danger zone," (thirteen to twenty-fifth course—there are 29 courses in all) should be secured by filling all horizontal joints with grout and by drilling 1½-in. holes at the lower corners of each block and filling these also with grout, on the theory



TYPICAL SECTION OF DAM



PLAN

BELLE FOURCHE DAM PAVED WITH GROUTED PRECAST SLABS

that the mortar would work down into the underlying gravel and form a lug below the block. Subsequent examination proved that the work as outlined was never accomplished, as in most instances the grout did not penetrate the full thickness of the blocks either at the joints or in the keys at the corners. Very few cases were found where a lug was formed at the bottom of the key below the blocks.

Minor disturbances occurred subsequent to the 1912 storm, but no serious trouble was experienced until May 10, 1916, when a windstorm of considerable violence, lasting for more than 24 hours resulted in the displacement of 366 blocks in the revetment between stations 12 and 44, and in slight disturbances at a number of other points. The maximum wind velocity noted for a short period during this storm was 60 miles per hour, resulting in waves approximating 5 ft. from trough to crest, or about the same as in 1912. Spray from the waves rushing up the slope was carried in sufficient quantities by the wind to thoroughly drench a pedestrian walking along the top of the dam. The direction of the wind was northwest, or normal to the axis of the dam.

Water Back of Paving.—A peculiar condition noticed in both the 1912 and 1916 storms was the spurting of water from the joints at and just above the water line upon recession of the waves. The maximum length of jet noted was approximately 18 in. normal to the surface of the pavement. This would seem to indicate that during the period of recession of the waves a considerable superelevation of water existed behind the blocks at the water line. The height of this superelevation and the forces resulting therefrom evidently overcame the weight and frictional resistance of the blocks and gradually lifted them from their bed.

After studying the effects of the storm and considering various plans suggested to make the revetment permanently safe against damage from wave action, and in view of available equipment and experiments previously conducted, the following plan of repair was adopted:

1. To chisel or V out all joints between the thirteenth and the eighteenth courses to a depth of about 5 in. and to refill with a good grade of cement mortar.

2. To relay all blocks from the eighteenth course to the top of the dam, placing the blocks with long dimensions up and down the slope breaking horizontal joints and leaving the vertical joints continuous; blocks to be placed on undisturbed gravel where possible and great care to be exercised in keeping the surface of the gravel bed uniform.

3. To fill all breachs with unscreened gravel well rammed and puddled.

4. To lay all blocks with open joints 1 to 2 in. wide and to fill the joints with a good grade of cement mortar.

The work of relaying the upper course of blocks was commenced Sept. 2, 1916, under the direction of R. V. Sass, superintendent of construction.

On Sept. 11 the second shift was put on and a little later the third. All three shifts were used until the work was nearly completed. The blocks were handled by a 50-ft. boom, revolving derrick. The blocks were removed in such a way as to form a V-shaped opening in the revetment. The derrick moved along the top of the dam picking up blocks in front and relaying them behind.

The work was carried on in eight-hour shifts with nine men comprising a crew as follows: One shift boss, one crane or derrick man, one swing man and six laborers. Two laborers on the slope in front lifted the blocks and fastened the dogs, and four at the rear smoothed the surface of the gravel and slid the blocks into place. Pieces of wood 1½ x 1½ x 4 in. were used to separate the blocks until they were grouted in.

V-ing the joints was begun on Sept. 19 at station 53 and was carried back to station 4 except between stations 14 and 21, where a projection of high land protects the pavement. Back of station 4 the pavement is not affected by wave action, as it is protected by bending of the shore line. The blocks between stations 4 and 12 were not relaid, but all joints in this section were V-ed to the top of the dam.

The compressor and dinkey used in connection with the chiseling out of the joints were passed around the derrick by means of a temporary trestle. Wagons loaded with gravel for the cement work were swung around the derrick by means of the boom. The chiseling was done with hand air drills. Four drills were used at first, but later five were operated almost continuously with three shifts of eight-hours each. The steel used had a wedge-shaped point slightly bent. Joints were opened to a depth of 5 in. The air was furnished by a compressor having a capacity of 153 cu.ft. per minute, mounted on a flat car and transported on a 3-ft. gage track previously laid along the top of the dam. Power was furnished by an old 18-ton dinkey locomotive—a left-over from construction days. By this arrangement it was possible to move the compressor without delaying the work.

Grout was made with 1 part cement to 3 parts sand, passing a ½-in. mesh screen. For the larger joints a coarser gravel was used in order to get more strength of concrete. The mixture was made quite sloppy and dumped directly onto the pavement at the upper end of the vertical joints. It was then worked down the slope and into the openings. No difficulty was experienced in getting the mortar well into the joints and the gravel bed below. All blocks were thoroughly wetted and all V-ed joints carefully cleaned before grouting was done. Two shifts of eight hours each were used on this work most of the time. Three shifts were used for a short time only. Each shift comprised about 15 men. Light was supplied by eight acetylene lamps. L. A. McConnell was in charge of this feature of the work.

The maximum number of linear feet V-ed per shift of eight hours was 498, and the average per shift was 372. The total number of linear feet of joint V-ed was 49,913. The maximum number of blocks relaid per shift of eight hours was 130, and the average number per shift was 57. The total number of blocks relaid was 6,466.

With comparatively few exceptions the paving blocks were of good quality and were not injured by rehandling. Over a small area, however, well toward the south end of the dam, a rather large percentage of blocks broke while being tipped up for grappling. In a small percentage of instances the grouting and keying previously done offered some resistance to the removal of blocks.

In one place a pocket with an area equal to four or five blocks was found where the gravel had settled away from the pavement at least 1 ft., and the blocks were held up by being slightly arched and tightly wedged together. Slight settlement was noticed in a number of other places, but of so little extent that it probably had little effect on the pavement. In general the bedding of the blocks was excellent, and whatever settlement had taken place in the dam had been followed by a corresponding adjustment of the gravel and paving.

When the work was completed the whole face of the dam took on the appearance of one continuous monolithic slab of concrete. The work was so well done that after a year's time with temperatures from 30 to 110 deg. Fahr. there was nothing more than hairline cracks anywhere to be seen in the pavement, and at the close of the third season (1919) there was still not the slightest suggestion of failure or defect, notwithstanding the fact that during these three years the reservoir has been filled to the spillway crest and the heaviest storm to visit this section of the State since the construction of the dam had been experienced.

New Water-Supply for Phoenix, Arizona

Phoenix, Ariz., has awarded contracts for a 36- and 38-in. gravity redwood pipe line 32 miles long, to bring Verde River water to the city from the mountains to the north. The supply available is reported to be sufficient for a city of 100,000, three times the present population. Phoenix now gets its water supply from deep wells and pumping stations and this source is unsatisfactory because minerals and sulphates in the water shorten the life of plumbing fixtures and give a disagreeable taste. Preliminary work for the new supply is now under way but construction of the conduit will not commence until September, and it will be approximately a year before the line will be completed.

Lake Harbor Planned at Milwaukee

Scheme Adopted by City Contemplates Piers, Terminals and Warehouses on Jones Island and Lake Shore

PLANS for a complete revision of the port facilities of Milwaukee, Wis., which will be executed at the rate of about $500,000 per year, have been adopted by the Harbor Commission and, as provided by law, submitted to the Common Council for approval. The proposed scheme involves an elaborate development of an outer harbor, which has not hitherto existed at Milwaukee, and the addition of terminal facilities on the outer shore of the inner harbor at Kinnickinnic Bay. Preliminary preparations for the work involve the reclamation of land on Jones Island, much filling behind a new bulkhead north of the harbor entrance, and construction of additional breakwater to protect the outer harbor.

At the present time no wharves or terminals exist on the lake front of Milwaukee, but all shipping is taken care of in the rivers emptying into the lake there. Entrance to these rivers is protected by parallel jetties and by a lake breakwater northward of the entrance. The southerly river has natural protection in Jones Island, so called, which is in reality a narrow, irregular peninsula juting out parallel to the shore and at present occupied only by fishing shacks and, at its north end next the harbor entrance, by the new sewage disposal works under construction.

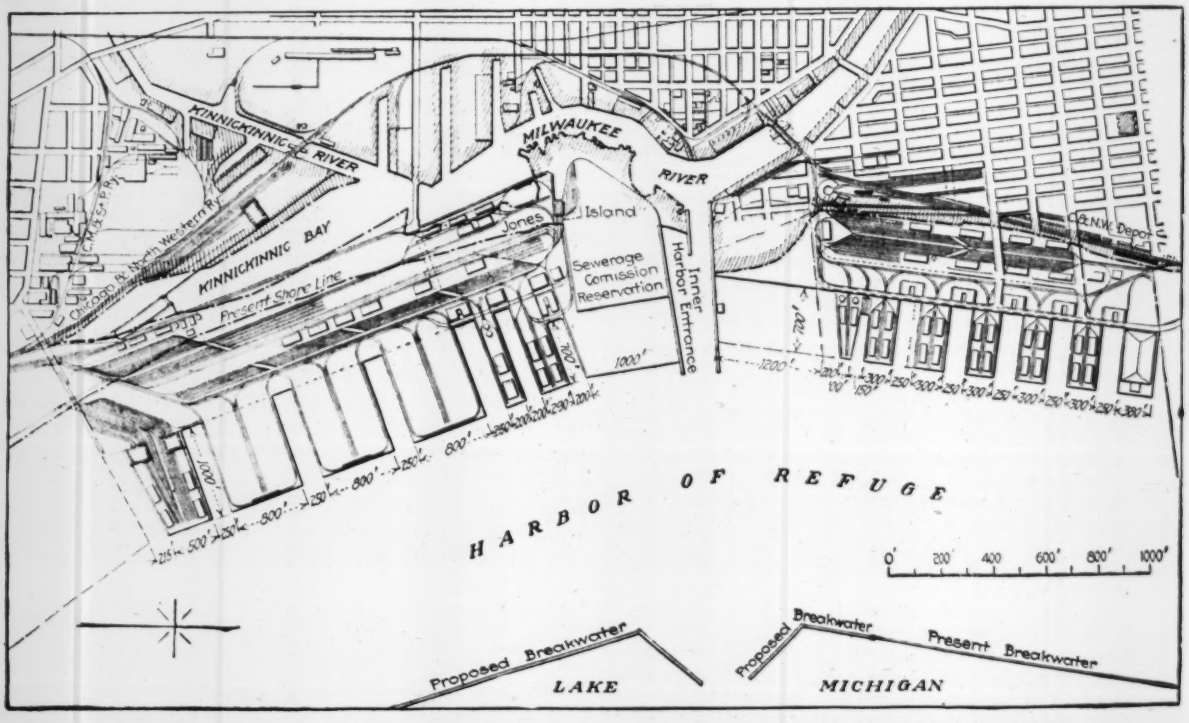
The outlines of the new development are indicated on the accompanying map and comprise three separate sections, one along the inner side of Jones Island, one along the outer or lake side of Jones Island, and one along the lake shore north of the harbor entrance.

Along the inner side of Jones Island there will be a quay extending from a proposed car-ferry slip south of the Sewerage Commission's reservation to an extension of the north side of Greenfield Ave., a distance of about 1,500 ft. Just south of the sewage disposal plant will be the two-car ferry slip 100 ft. wide at its inner end and 150 ft. wide at the outer end. Toward the northerly edge of the quay for a distance of about 300 ft. are located coal pockets for fueling ships and near the south edge of the car ferry slip tanks for fuel oil. South of the car ferry slip and east of the coal pockets is an area of about 600 x 400 ft. for the storage of coal. South of this storage area is one quay unit 600 ft. front and 300 ft. wide devoted, according to the general plan, to miscellaneous cargo.

Between the Greenfield Ave. bridge, which it is proposed will be a bascule bridge with 200-ft. span affording easy communication between the manufacturing district to the west of the river and all parts of the terminal on Jones Island, and the present juncture of Jones Island with the shore is an area devoted to coal storage and, at the extreme southerly end, to a dry dock with appurtenances.

The outer harbor south of the entrance is made up of wide piers extended out from a much enlarged ground area of Jones Island. At the south end is a grain elevator pier, 1,000 ft. in length with a slip on one side 250 ft. wide and on the other 215 ft. Provision here is made for two grain elevators of 1,500,000 bu. each. Next, to the north, would be three large coal piers, each 1,000 ft. long and 800 ft. wide for the handling and storage of coal, each with rear land having a holding capacity of over 400,000 tons. North of these would be two other piers 1,000 ft. in length and 200 and 290 ft. wide respectively. These are to be used for miscellaneous cargo.

North of the harbor entrance there are designed six piers and six slips, besides a recreation pier. Five of these piers are 300 ft. and 700 ft. long; one, 100 ft. wide at the outer end, and 300 ft. wide at the shore end;



MAP SHOWING PROPOSED DEVELOPMENT OF LAKE FRONT HARBOR AT MILWAUKEE WIS.

and the recreation pier, 380 ft. wide and 700 ft. long. The slips vary from 200 to 250 ft. in width. These piers all extend out from the bulkhead line which is at the rubble mound that has just been completed by the city.

As indicated on the drawing, all of the new terminals are fully equipped with railway tracks. The Jones Island development in addition to being tied up by tracks to the car ferry slips is connected at its southern end with main-line tracks running over to the existing railways on the mainland. On the north side of the harbor entrance there are two tracks on each side of each freight pier with crossovers every 100 ft. At the center of each pier will be three tracks with track connections between all the tracks of the pier. There is a railway connection here to the south through Polk St. and with the Chicago & Northwestern Ry. at the north, near Wisconsin St. Viaducts also are indicated over the tracks for roadways to connect with the numerous terminals of the northern development and there is a marginal way paralleling the whole length of the water front.

In general the terminals north of the harbor entrance are for miscellaneous cargo and package freight, although open spaces are provided for coarse or bulk freight on every pier. On each of the five full piers are four sheds separated from each other, each being 200 ft. long and 70 ft. wide with a clear height of 30 ft. beneath the roof trusses. At the head of each 200-ft. slip is a concrete warehouse of six stories so designed that the number of stories can be increased if desired. These warehouses are located 50 ft. to the rear of the front of the quay so that by means of traveling gantry cranes loads can be transferred directly between the warehouses and barges lying alongside of the quay at the inner end of the slip. To the rear of the storage tracks are other additional warehouses in which cargoes can be held either for or from merchants in the adjoining district. Approaches are provided to all these warehouses by roads for trucks and drays as well as by rail.

While on detailed designs are submitted at present, it is intended to provide freight-handling machinery of the most advantageous type in all parts of the port development. Permanent construction mainly of concrete is recommended for these piers and warehouses.

The present work on the harbor consists only in the completion of the rubble mound at the harbor entrance, the filling behind which is also going on, and the construction of a revetment along the inner side of Jones Island. It is intended, however, to proceed with the work at the rate of about $500,000 per year, the money for which is raised by a bond issue. All construction is carried on under the direction of the Milwaukee Harbor Commission, of which W. T. Bruce is chairman. The proposed plan for the development of the harbor was perpared by H. McL. Harding, consulting engineer, New York City, who was retained for that purpose by the Harbor Commission.

Aqueduct Proposed for Argentine City

The City of Mendoza, Argentine, has requested an increase in the municipal water supply. A plan to use the waters of the Rio Blanco, and at the same time to construct an electric power station at the falls of this river has been approved by the governor of the Province and is now before the Minister of Public Works of the nation. The project will mean the construction of an extensive terminal and aqueduct system, estimated to cost $5,590,000.—*Commerce Reports.*

Concrete Road Uninjured By Weight of Ice Jam

Ten-Foot Fill Under 6-8-In. Slab Laid in 1919 Alone Suffers From Heavy Cakes That Bury Pennsylvania Highway

TWELVE miles north of Harrisburg, Pa., the Susquehanna River breaks through a mountain range known locally as the Blue Mountains. The bluffs on either side are quite high and very steep, their shoulders projecting out into the river valley, forming the Juniata Narrows of the Susquehanna. Due to the restricted width the river flows with great swiftness at this point, washing very close to the base of the rock cliffs. Two miles above the Juniata Narrows the Juniata River joins the Susquehanna from the west at a point known as Clark's Ferry. In times of flood the eastern bank from the river junction to the narrows is subject to

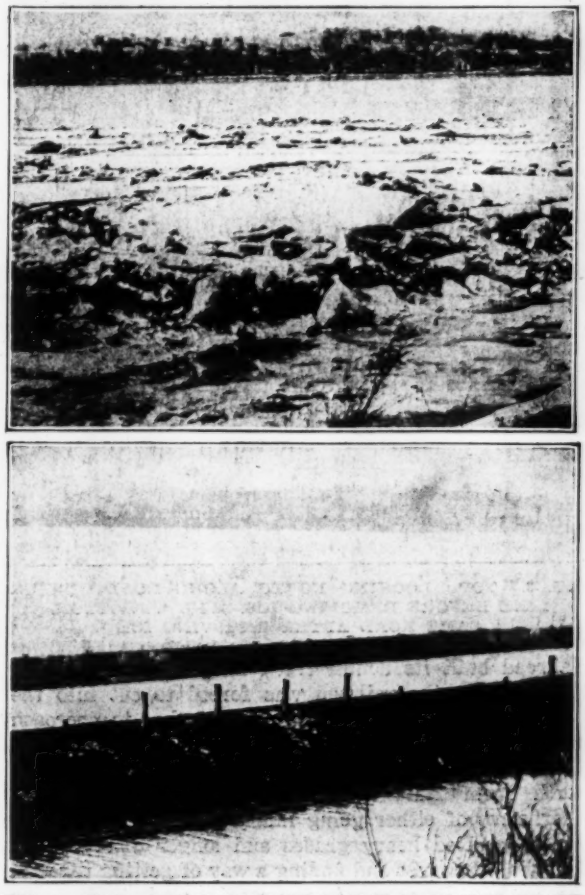


FIG. 1. TOP. THE LARGE ICE BLOCK IS IN THE EXACT CENTER OF ROAD. FIG. 2. BOTTOM. THE SAME SPOT WITH THE ICE CLEARED AWAY

severe scouring action, due to the large volume of water from the Juniata forcing the current close to the eastern shore. In the early spring, when the ice breaks up, large cakes are often thrown high and dry on the eastern bank above the narrows.

When the old Pennsylvania Canal was built along the shore of the Susquehanna, the engineers were forced to run its line very close to the foot of the projecting cliffs of the Juniata Narrows. Then the Pennsylvania

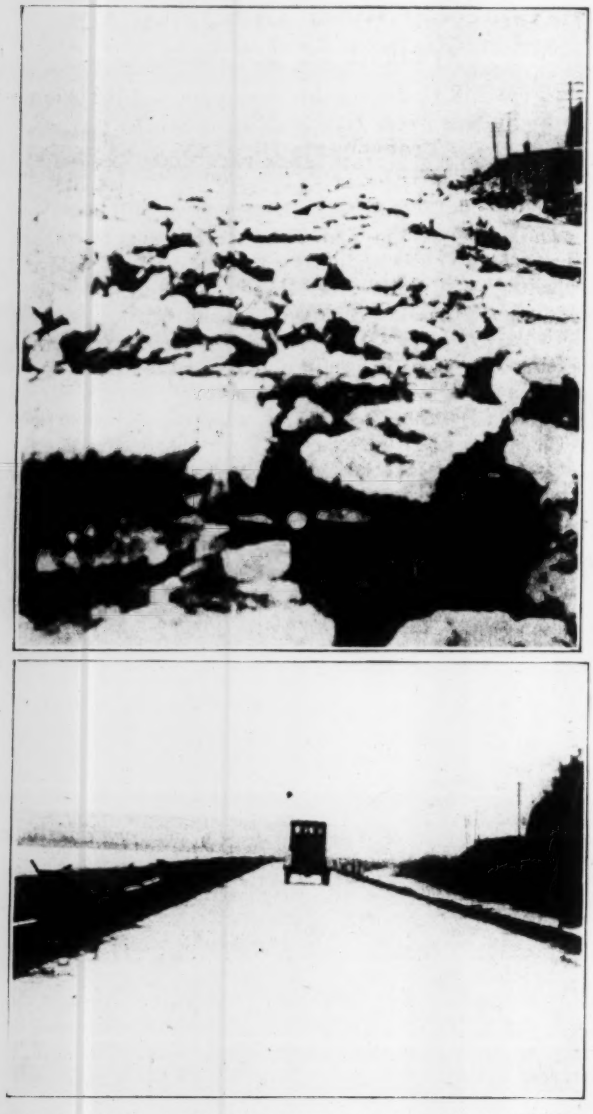


FIG. 3. TOP. LOOKING NORTH ALONG ROAD CENTER LINE BEFORE REMOVING ICE. FIG. 4. BOTTOM. SAME ROAD AFTER REMOVING ICE

Railroad built its double track line up the river. At the Narrows the railroad was forced to cut into the rock slopes on one side, and on the other to encroach on the old canal prism with the fill for the right of way.

The State's highway engineers in building a road north from Harrisburg were confronted with the alternative of either going inland over the mountains, which involved heavy grades and longer distances, or following the river and finding a way of getting through the Juniata Narrows. As the road is an important one —being a part of the William Penn Highway and the Susquehanna Trail—engineers followed the latter course, using the towpath of the old canal as the basis of the new road. Considerable heavy filling was necessary to extend the towpath into a modern highway and most of the borrow was taken from the canal bed, being practically the only material available except at prohibitive cost. The fill was built up to from 8 to 10 ft., the upper 2 ft. being cinders. To protect it against being scoured by the river a masonry and concrete wall, rising 20 ft. above mean low water, and with a pipe railing along its entire length, was built between the narrows and a point opposite the mouth of the Juniata River.

The fill was made during 1918 and upon it in 1919 the state highway department laid a concrete pavement of a 1:2:3 mix, 18 ft. wide, 6 in. thick at the sides and 8 in. at the center, and reinforced with wire mesh weighing 25 lb. per 100 sq.ft., such a design being the Pennsylvania standard.

The severe winter just passed covered the watershed of the Susquehanna and its tributaries with a heavy blanket of snow and held the Susquehanna ice-bound for 80-odd days. A warm rain and a rising temperature over the western part of the watershed brought the Juniata down in flood. The ice at the junction was breaking but had not begun to move. The great mass of ice and water from the Juniata added to the congestion at the narrows and mountains of ice were piled high at this point. As it did not break, ice above the narrows piled higher, reaching the eastern shore, and making for what was considered one of the worst seasons in the history of the river.

The water and ice backed up over the river banks causing considerable damage in the town of Duncannon on the western shore, and covering the road with 5 ft. of ice and water on the east. This condition prevailed March 7. The Juniata subsided below the level of the road March 10. The following day, however, the Susquehanna broke—which made matters worse as the ice in the narrows still held. The gorge cleared March 14 and as the water subsided a deposit of ice cakes ranging in size from 2 ft. square to 20 x 30 ft., and 2½ ft. thick was left on the road.

This deposit was three or more feet in depth and covered a section above the narrows about 1,600 ft. long, and below the narrows 1,000 ft. Following the breaking up of the ice the water fell rapidly, causing considerable damage to the fill below where the ice had jammed. The fill was thoroughly saturated during the period of the flood and for some time thereafter and the road was subjected to not only the weight and action of the heavy ice cakes but was undercut in places as much as three ft. How the fill suffered is shown in an accompanying photograph. Knowing the character of the foundation many engineers doubted that they would find the slab entirely uninjured when the ice was cleared away.

By March 20 the force of men that the state put upon the road had practically cleared it of ice and

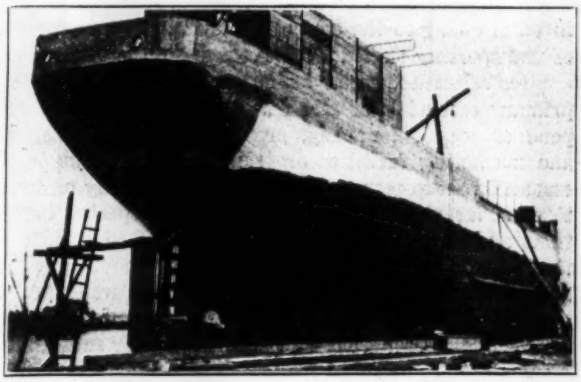
FIG. 5. THREE-FOOT UNDERCUT FAILS TO INJURE CONCRETE SLAB

debris. Smaller cakes of ice were either thrown or pushed off the road, or butted off with motor trucks. The largest cakes were removed by fastening chains to them and hauled to points where they could be dumped into the canal.

An inspection of the road made April 1 failed to show any damage to the pavement as the result of its unusual experiences. The fill, however, had been damaged somewhat and the pipe rail was entirely destroyed in places, the posts being driven into the ground by the weight of the ice. The concrete wall protecting the river side of the fill was undamaged. A series of photographs was taken when the ice covered the road and after the road had been cleared and several of them are reproduced herewith. They were taken in sets to show the same spots, during the ice jam and afterward.

Experimental Concrete River Steamer Is Built in Argentina

CONCRETE for ship construction has been used experimentally for one small river steamer in Argentina, according to information from the United States Department of Commerce. The accompanying view shows the vessel on the ways. It has a length of 131 ft., beam of 23 ft., and the depth of the hold is 16 ft. Its displacement is 600 tons and carrying capacity 450 tons and is driven by two 50-hp. oil engines, which give



600-TON CONCRETE RIVER STEAMER ON WAYS IN ARGENTINA

a speed of 7 miles per hour. This power plant will later be replaced by two 100-hp. engines. It was built for river service, and is now making regular trips between Buenos Aires and Montevideo. The vessel was designed and built as an experiment by Hume Bros., a company of Anglo-Argentine civil engineers. In spite of a great need for river boats the company has had to prove the value of the concrete ship by actual operation. The ship was used for three months to carry sand and stone from Sauce, Uruguay, to the Argentine port of La Plata, on which work it brought in a net profit of over $5,000, U. S. currency. The cost of construction was somewhat higher than for a wooden ship of equal size on account of the experimental nature of the work, but the builders state that the price can be reduced considerably below that of wooden ships. Lumber is scarce and expensive in Argentina, and it is hoped that the river service companies will look to the concrete ship as a solution of the demand for tonnage.

Industrial Decentralization as a Cause for Regional Planning

By Thomas Adams
Town Planning Advisor, Canadian Commission of Conservation, Ottawa, Ont.

IT HAS come to be recognized that the planning of cities and towns involves consideration of wider areas than are comprised within the arbitrary boundaries of municipalities. This is partly due to the need of making the boundaries of city plans adaptable to conditions of natural topography, which too seldom influence the selection of the administrative boundaries of cities, but it is also due to the modern tendency of manufacturers to locate their plants outside the city boundaries and thereby create wide belts of industrial development all around the city areas. The need of planning of these new regional developments is creating a serious problem for all growing cities.

In nearly all countries that have city planning legislation, including several states in the Union, the need for planning suburban regions surrounding cities and towns is recognized by the power given those municipalities to approve the planning of subdivisions within three to five miles radius outside their boundaries.

These considerations are chiefly responsible for the movement that has come to be known as regional planning. Many of the forces that formerly encouraged concentration now encourage the dispersal of industry. As factory buildings become old, and less adaptable to new processes of manufacture; as room for expansion in crowded cities becomes more restricted; as transportation and highways improve, the balance of advantages in favor of dispersal grows in volume. Transportation facilities, for the majority of industries not needing water communication, are better outside than inside cities.

There have been only two serious obstacles to the movement toward dispersal, namely, the limited area for obtaining a supply of power and the absence of housing accommodation in country areas. The first of these obstacles has been removed in many districts by the development of the system of distribution of hydro-electric power over wide areas. The difficulty of obtaining housing accommodation in rural areas still operates to prevent the removal of works away from existing centers of poplation, but it is not sufficient to stem the tide of industrial migration from the cities.

Reasons for Removal of Industries

An investigation being made in Montreal and Toronto for the Canadian Commission of Conservation by Capt. G. H. Ferguson, M.E.I.C., shows how strong the centrifugal movement of industry is in these cities. The chief reasons found to influence manufacturers in moving away from the central areas of the chief cities in Canada, are, in the order of their importance: (a) To obtain room for expansion of works where land can be purchased at moderate prices. (b) Improved railway facilities. (c) Lower assessment with lower taxes. (d) Better conditions for the persons employed in the industry. (e) Better quality of labor. (f) To obtain better premises and lower insurance rates. (g) To centralize a more or less scattered plant at one headquarters. (h) To be adjacent to works engaged in allied industries. (i) To be adjacent to source of raw materials. (j) Lower rates for power service. (k) Improved facilities

for delivery of product to residential portion of city. (l) Freedom from dust and dirt of a location in the central portion of the city. (m) Freedom from arbitrary city by-laws.

In America established industries are leaving the cities and migrating to semi-rural districts.

The large cities that are losing their industries and revenues should consider how to convert the movement to their advantage and prevent serious losses of revenue by reduction of assessable values and how to prepare regional plans so as to prevent the recurrence of evils that have caused the dispersal of industries from the city areas. This movement is taking place under conditions that will inevitably repeat the same evils unless the new areas are properly planned.

The Disease of the Modern City

There is a growing body of opinion in favor of the disintegration of existing large cities. This opinion appears to be based on the assumption that the size of cities is in itself an evil—whereas the real evil is not the extent but the character of the growth. The modern city is not suffering from any excessive natural growth, but from a sort of elephantiasis, caused by congestion and speculation obstructing the vessels of the civic body that are necessary for natural growth. The disease can be prevented by proper city planning, but if once allowed to become severe it may be necessary to amputate the parts most affected and replace them with new parts. Such is the solution suggested for the slum areas at a cost that is almost prohibitive to the average city.

The want of proper control of land development causes not only undue density of buildings in parts of our cities and undue scattering of buildings in other parts, thereby increasing taxation and driving industry away, but it also increases the difficulties of carrying on business with despatch and efficiency, and the straining of public utilities beyond their capacity.

The scattering of residences and factories over our suburban areas—which, with proper planning, should be a most beneficial movement—causes loss and injury to the community by reason of the haphazard development and the consequent waste of public utilities. As unplanned cities grow, the costs of administration increase rather than decrease. Transportation, while becoming more centralized, becomes more rather than less costly. All the advantages of better sanitary conditions are lost for lack of air space around the

The growing cost of food is not entirely due to war conditions. It has been partly caused by the artificial cleavage set up between the city and the country. The present tendency toward decentralization, if properly organized, could help to remove the causes of this cleavage. Hundreds of thousands of acres are lying idle around American cities waiting for buildings that will not come for generations and producing no food at the door of the consumers. While the widening of the area of urban development is a good thing in itself, it is losing most of its advantages because of this wasteful speculation and want of planning.

Most of our cities and towns are facing financial problems created by the above conditions that will tax the wit of man to solve in the near future.

The difficulty of curing the disease in the existing city has given rise to proposals made in England for creating new towns on new sites. A garden city is a self-contained town developed on an agricultural site by securing a concerted movement of manufacture from crowded centers; having the greater portion of its area permanently reserved for agricultural purposes so as to combine town and country conditions; so organized as to give to the inhabitants the benefit of the increase in land values due to the conversion of the site from agricultural to industrial purposes.

The ready acceptance of the belief that manufacturing cities are a natural growth and not an artificial creation has made it difficult for some people to realize the practicability of the creation of new towns. Natural law has much to do with the concentration of industries in particular localities, but in the main, cities and towns are artificial creations. Dr. Arthur Shadwell, an English publicist, expresses the view (*Industrial Efficiency*, p. 47) that "industrial districts become so by reason of natural advantages" and that this is not fully realized by promotors of "garden cities." This is only a half-truth. Industries are constantly changing their locations, in spite of the lack of organization and means to facilitate the making of changes. Dr. Shadwell admits it, in contradiction of his own view that "those who cry 'back to the land' and advocate the removal of industries to the country do not seem to be aware that it is perpetually going on. Factories are constantly being put down in country places." This industrial movement is proceeding rapidly in spite of the natural tendency for industries to remain rooted in the wrong location, long after it is proved to be economically unsound to remain in them owing to the cost of removal and the difficulty of transporting skilled labor from one place to another.

Sites selected for new towns must possess two of the primary essentials of manufacturing industry that depend on location, namely, proximity to raw materials and marketing facilities or transportation. The third essential, cheap power, may also depend partly on location but largely on the absence of the hampering conditions and vested interests of old established communities, and on the value of planning the producing plant and system of distribution in relation to a well-planned and concentrated factory area. In this respect the building of a new town affords an opportunity for substantial economies and improved facilities. The fourth essential, skilled labor, can be attracted anywhere if good housing conditions are provided, and in this connection the "garden city" has the advantage over the typical higgledy-piggledy town that has grown up in the past.

There are plenty of sites with great natural advantages in America and Britain for building new towns and the regional survey is the first step necessary to ascertain the best situations for such towns.

Whether our solution of the problem of city growth and industrial expansion be by controlling and planning metropolitan areas within and adjacent to existing cities, or by planning and developing new cities, it must be based on regional units of area and not limited to individual cities or parts of cities.

It is certain that in the future science will be applied to town development as it has been applied in the past to the development of the mechanical processes of industry. When that time comes we shall have both new towns and new suburbs of existing cities organized and planned, in the interests of health and convenience. For both purposes the regional survey and the regional plan of area adaptable for industrial development are essential preliminaries.

Earth, Clay and Sand Roads—Their Improvement and Maintenance

Extracts from a Paper Read by A. R. Hirst Before the Seventh Annual Canadian Good Roads Congress, Winnipeg, June 1-3

SOUND advice for that large body of engineers whose chief concern is the proper improvement and maintenance of rural highways was embodied in the paper read before the seventh annual good roads congress held under the joint auspices of the Canadian Good Roads Association and the Manitoba Good Roads Association, by A. R. Hirst, chief engineer of the Wisconsin State Highway Commission. The chief points emphasized by Mr. Hirst are reproduced herewith:

(1) Earth roads will, for all time, comprise the largest fraction of our road mileage; therefore their intelligent construction and maintenance are of paramount importance.

(2) They should be given a proper cross-section adjusted to the soil of which they are made and to the drainage conditions prevailing, as rapidly as funds can be made available for the work. Gang maintenance grading methods should be used where funds are not available for the final grading.

(3) They should be well drained by providing them with proper ditches, waterway structures of adequate size and blind stone or tile drainage where necessary.

(4) The most careful attention should be given to the real road terrors—those sections upon which traffic is constantly being stuck. Such sections constitute an astonishingly small percentage of the total mileage of earth road, and cause an astoundingly large percentage of the traffic troubles on earth roads.

(5) The grading and draining of earth roads is of little value unless it is immediately supplemented by an intensive system of patrol maintenance.

(6) The surfaces of many earth roads should be modified by application of the proper material if they are to be maintainable properly and are to give efficient service.

(7) These modifiers are: For sand roads, clay or clay gravel; for clay roads, sand or sandy gravel.

(8) Given proper drainage and the proper modification of the top surface, earth roads will give satisfaction during the summer traffic season on roads carrying almost an indefinite amount of traffic.

(9) They will, however, if on clay, fail to give service on very heavily traveled roads and practically on all other roads during the spring break-up and during prolonged wet seasons when their surface cannot be given effective smoothing.

(10) The maintenance of earth roads should take the form of patrol maintenance, a man and team or a man and motor truck being given a specific section of road for the condition of which section he is made entirely responsible.

(11) The best tools for the maintenance of earth road surfaces are: (a) The light two-horse blade grader, and (b) the Minnesota or the Wisconsin planer. Split logs and other forms of drag should be seldom because they go down into every transverse depression and upon every transverse ridge and accentuate these defects instead of removing them.

(12) Very moderate crown should be used on the traveled way of all earth roads. They should be maintained flat until the road has to be made ready to go into winter quarters when the crown should be increased.

(13) Most of the modifications for earth road surfaces to make them more maintainable and more passable are slow processes. Additions of material are best made a little at a time and then worked, mixed, and smoothed, additional material being used as necessary until a maintainable surface is finally secured.

(14) It is obvious that in practically any unit of government, given the alternative of spending all of the highway funds available in regrading and draining earth roads and in the modification and maintenance of their surfaces, or of expending all of the funds available in the construction of a few miles of surface roads, the people of the unit of government will receive much more benefit if the money is expended in the regrading, draining, modifying and maintaining.

(15) This does not mean that I believe that construction should be neglected. It must be pushed as fast as it can be financed, but the speed of construction can well be retarded, if necessary, to provide for the proper maintenance of all important roads.

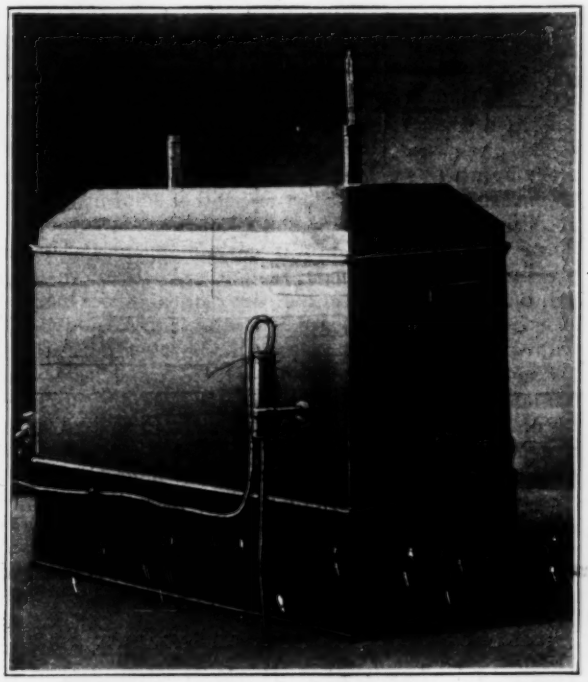
Cement Testing Steamer Heated By Electricity

Home-Made Apparatus Suitable for Small Laboratory Made with Special Constant Water Level Device

By Howard H. George
Assistant Engineer, Public Service Ry. Co., Newark, N. J.

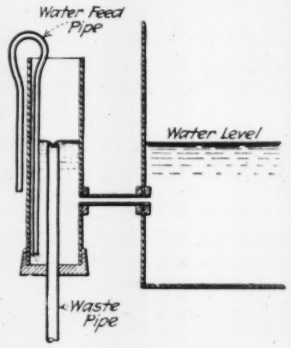
AS PART of the equipment of a small cement laboratory in connection with the construction of the Public Service Terminal, at Newark, N. J., the writer had occasion to design and build a small heater to be used in the steam tests of the cement. The location of this laboratory was at a point where no gas supply was available and where the use of a gasoline heating unit was prohibited because of the fire risks. The source of heat was therefore restricted to electricity, direct current from the 550-volt trolley circuit being the only current near enough to be readily connected with the laboratory.

The boiler was the 12 x 12 x 24-in. standard copper vessel with tray and lid, containing two steam vents for insertion of thermometers. A special constant water-level device was designed which shows very plainly in the accompanying view. It consisted of a small brass cylinder, open at the top. A nipple con-



COPPER STEAMING APPARATUS WITH ELECTRIC HEATING COILS AND CONSTANT WATER-LEVEL DEVICE

nected this with the water chamber. Running through the bottom was a small copper waste pipe, the top of which was set at such a level that the overflow began when the water in the boiler had reached the desired level. The water-supply line was another small copper tube curved to enter the cylinder at the top and discharge in the bottom. During the operation of the apparatus a very small flow of water was sufficient to maintain a constant level in the boiler. The operation of this device is shown more clearly in the accompanying diagram.



SECTION THROUGH CONSTANT WATER-LEVEL DEVICE

The heating unit consisted of five coils in series, each wound on an ½ in. mandrel, 20 in. in length. They were copper wired with sheet mica insulation and had eleven turns per inch. A ¾-in. rod runs through the center of each coil with hard rubber caps at each end. The five coils, designed for 110 volts each, are connected in series on a 550-volt d.c. line and consume 8.2 amp. It proved very satisfactory and efficient.

The following data are of interest in connection with the length of time required to bring the water to the boiling point by this method:

Volume of box, 12 x 12 x 24 in.	3,456 cu.in.
Volume of coils and water, 12 x 12 x 5½ in.	1,674 cu.in.
Volume of air and steam	1,782 cu.in.
Volume of water	1,603.44 cu.in.
Area of heating surface	231.94 sq.in.
Volume of coils	70.56 cu.in.
Temperature of water at starting point	53° Fahr.
Temperature of room at starting point	63° Fahr.
Temperature of room when water reached boiling point	67° Fahr.
Time required to raise water to boiling point	30 minutes

Making Wood Fire Resistant with Paint

Fire retardent paints are the most practical means so far discovered by the U. S. Forest Products Laboratory by which small amounts of wood can economically be made fire resistant. The only other known methods of decreasing the inflammability of wood are to keep it wet, or to inject into it certain chemicals under pressure. These methods, though more effective than painting, are usually either impracticable or too expensive to be considered. Ordinarily calcimine or whitewash has proved in tests to be as fire resistant as any paint covering tried. It is cheap and convenient to use. Although it will not prevent the burning of wood exposed continuously to a high heat, a good coat of calcimine on wood will decrease the danger of a blaze spreading from burning cigarettes, sparks, matches, and similar small sources of fire. Calcimine is, of course, more effective for inside than for outside use.

For exterior use numerous patented fire retardent paints are available. An effective outdoor paint which has been developed at the Forest Products Laboratory consists of linseed oil, zinc borate, and chrome green. This paint has maintained its fire resisting properties through more than three years of exposure to the weather.

Engineers—From the Business Man's Point of View

Extracts from Address by Homer L. Ferguson, Past-President of the U. S. Chamber of Commerce, Before the Organizing Conference of Engineering Societies, Washington, D. C., June 3-4.

As I understand it, the main purpose of your meeting is to co-ordinate in some way the engineering societies and the engineering thought of the country, as embodied in those societies, and to perform public service. So, as far as the cooperation of the individual engineer in business matters and in his organizations is concerned, I can assure you it can be done, because I have been doing it in a number of ways for the last six or seven years, and there is nothing connected with the game to be frightened at. In fact, engineers have a distinct advantage over business men in that they may easily and readily qualify as business men in practically any capacity, and practically no business man, as such, can qualify as an engineer. And so, to cooperate individually as engineers, all that is necessary is to assert your rights and your duties as business men. And that can be done in any community. Business men, in my experience, welcome it. They are glad to have your advice, and there are practically no problems concerning local business administration in which the engineer is not needed and not welcome.

Engineer Needs Self-Confidence

The only disadvantage the engineer labors under, or the only two disadvantages, so far as partaking in public assemblies is concerned, are, in my judgment, first, a reserved modesty which the practice of engineering rather enforces on a man; and, second, an ability to write a lot better than he talks. If I could change the engineering courses in the colleges of the United States, I would put in the curriculum the means to teach engineers to think on their feet. All of us know engineers of the highest attainment who, when asked to participate in a problem involving large amounts of new business, frequently act as though they have a "gold brick" to sell. They have been so modest that they have been unable to express themselves forcibly to business men, who want quick action, who want to be assurred by a more or less dominant note in a man who is negotiating with him.

I started out as an engineer, and, if you will pardon a personal reference, was in a business where the engineering was difficult enough, I believe, but where it depended absolutely for its continuance on public policy—on politics, in other words. And along with a great many engineers in my particular calling, that of ship building—we have had to come to Washington year after year for 25 years with our hats in our hands, asking that our business be considered as a national business; as vital to the best interests of the country. We were not listened to. We were considered as lobbyists, and not a line and not a word was written into the law affecting the sea that was desired by any ship owner or ship builder for 15 years.

You civil engineers went down and built a big canal, and then our lawmakers passed a law that American citizens could not own a ship going on that canal if, at the same time, they owned stock in a transcontinental railroad. And so, along with others, I made up my mind that if it was not possible to convince business men and my own associates that in the case of my particular business, which is a world-wide business, that we had a real case, that we deserved the backing of business men, there was not any need of going to Washington and talking to any one in political life. So I switched off engineering, pure and simple, and went into the publicity business on a large scale, and have been practising it more or less since. You won't have anything much in any business, nowadays, unless the voice of the profession to which you belong is heard.

Take for instance the recent railroad case. I know of a gentleman in Congress who voted in favor of the prohibition of strikes on railroads—I mean, the kind of a strike where everybody agreed to quit and not let anybody else

work. Every labor organization in his State went after him and from them he received thousands of telegrams, but he received only one letter, a very modest letter, from a business man, commending him for his stand. Notwithstanding that, there were at least 200,000 business men who thoroughly approved of his stand, but no one said so. There is such a thing as having brains and experience, but they do not do much good if you keep them to yourself. And that is particularly so here. The danger, as I see it, of any national organization is that it shall be used as a means of partisan politics, or promoting the interests of any particular party or of any particular man. As soon as it takes on that phase it loses its strength as an organization representing the sentiments of any class of citizens or of engineers. As soon as we get into the expert testimony class we lose something of our character as broad-gaged engineers.

Government an Engineering Job

The Government work is so vast and covers so many fields that it seems almost impossible for any group of men to grasp it all; and yet, in my judgment, there is engineering in it from start to finish. The things that are in the public mind today, like the budget system, the good roads movement, the rehabilitation of the railroads, water power conservation, the fuel question, the question of great central power plants for the conservation of fuel and for the purpose of utilizing railroads to the best advantage, are all in their essence engineering questions, and it thus remains for the engineers to take part in these questions. The difficulty with public service, gentlemen, is that you cannot put your finger on the thing that you did, unless, of course, you are a politician, and claim everything.

Work is accomplished by joint action. It is just like the movement of great bodies. Individual glory does not come to any man. The work can only be done through a sense of service and at a considerable sacrifice and effort. But, nevertheless, it needs be done. It needs to be done in a thousand different ways. And engineers, as citizens and as business men, who do not take part in public affairs are entitled to no more sympathy than the man who criticizes, for instance, the action of his Government, local, state or national, and yet does not exercise his right to vote and participate in political affairs. The advantage that engineering influence in the country would have over any other sort of organization, unless it were perhaps the medical man, would come, in my judgment, from their training. If we are taught anything at all it is to recognize the truth when we see it, and to know that red figures cannot be turned into black figures by argument. We do not seek to twist every fact we see into something which conforms to ideas which were inherited, let us say, when we were 21 years old, when we first voted. We seek the truth and speak the truth, and we stand for the one big idea on which the safety of the Republic rests, and that is proper information and education. We stand for the truth. We want the truth to be known, and we should insist that in large matters involving the expenditure of huge sums that it should be known as nearly as it may be known before the work is undertaken.

The Public Interest Neglected

Now, we have engineering societies which never affiliate with each other much. We get together and congratulate each other once in a while and discuss matters of interest. We seldom discuss things of public interest. We seldom discuss matters in relation to public affairs; and, in the meantime, we have in this country a great group of educated men who come pretty close to running the Government. Of course, the judiciary must be made up of the lawyers, and most of the administrative forces of Government are generally from the legal profession, and a very large majority of the legislative forces of Government are generally from the legal profession. Why? Their education is not more fundamental and no more general than that of engineers. It is because they have been trained to public service. It is because they have been trained to public speaking. Now, in the olden times I daresay the work of lawyers and the work of teachers and the work of preachers was the most important work that could be performed by any man in a public capacity. But who can say now, in these days of modern industry, that the profession of the engineer is not the most vital of the public professions? I believe it; and, as far as business men are concerned I have never hesitated to tell them that the engineer is the vital connecting link, and he is entitled to a voice. He can easily have a voice by simply getting up and being heard.

Much comment is seen in any paper you pick up of Labor running the world and of Capital running the world. Very little is said of the element of management and of brains. Gentlemen, brains run the world. Without them the vast resources of a power like Russia are inert and worthless; and without them, the millions of men in China, wonderful workers, are worthless. The connecting link between the two comprises those engaged in the engineering profession, and they are the people who have made it possible for the poor to have more than any or our fathers and grandfathers had, and for them to live in a state of comfort and decency wherever they have a mind to work.

Field for Constructive Work

I have not any suggestions, gentlemen, to make as to how the work here in Washington could best be done. I do know that there are public agencies with which this organization can become affiliated. I know there is a great deal of work to be done where specialists and experts are needed in connection with proposed legislation and present legislation, and that real constructive work can be done by men who are willing to give of their time and services to do this work. In the Chamber of Commerce of the United States, during the past five years, we have had to seek all over the United States to find men who are able and willing to give of their time in the preparation of reports on which business men throughout the country to the extent of 1,200 or 1,500 base their judgment as in favor of or against a particular thing. It has been very difficult to get men to do this work, and I am particularly delighted to know that these great societies have taken up this work of public service, because it is the most necessary and the most fundamental work in this country today. Eternal vigilance is the price of liberty, and those of us who love our country and who are willing to serve it anywhere must realize that only by serving it can we possibly make it a country worth while; that we have a real duty to perform as Americans; that we must not expect and will not get any pay for it at all, and frequently there will be a great deal of criticism. But I believe it is vital that our people should know the truth, should be advised of the truth in time, and put men in positions, not to represent themselves, not to represent special interests, but to represent the sound engineering opinion of the United States.

Meters Pay and Make Everyone Pay

The Commission has continued its policy of placing meters as rapidly as possible. On Dec. 31 the service was 92.2 per cent metered—there being only 64.9 taps on the flat rate—and we hope during the coming year to have all of these services metered. Too much importance cannot be given to the matter of metering the water to customers. In the first place, in a municipally owned plant, in which all of the citizens are interested, it makes everyone pay for the water used by them, and therefore, throws no burden on any one. In the next place, it is gradually making for better plumbing and more attention being given to the water supply by each one of our customers. Metering has meant the saving of a water famin in our city. It has converted an unprofitable run-down plant into a profitable, gradually improved efficient one, with no hardship on any one who uses, but does not waste the water. It would be utterly impossible for the Commission, with the present perfectly adequate water supply to the needs and uses of the town metered, to supply enough water to the city were it not for the meters.—From 1919 Annual Report of Commissioners of Public Works, Charleston, S. C.; J. E. Gibson, Manager and Engineer.

Design of an Octagonal Reservoir at Enid, Oklahoma

Depth and Shape for a Capacity of 2,000,000 Gallons Investigated for Economy Under Present High-Price Conditions

By I. S. Siegrist

Assistant Engineer with Black & Veatch, Consulting Engineers, Kansas City, Mo.

AMONG the improvements to the water-works system of Enid, Okla., now under construction, is a 2,000,000-gal. covered low service octagonal concrete storage reservoir, built half in excavation. The reservoir will store water from a new system of wells. Careful investigations were made of the economical depth of reservoir, shape and design of sections under present high-price conditions.

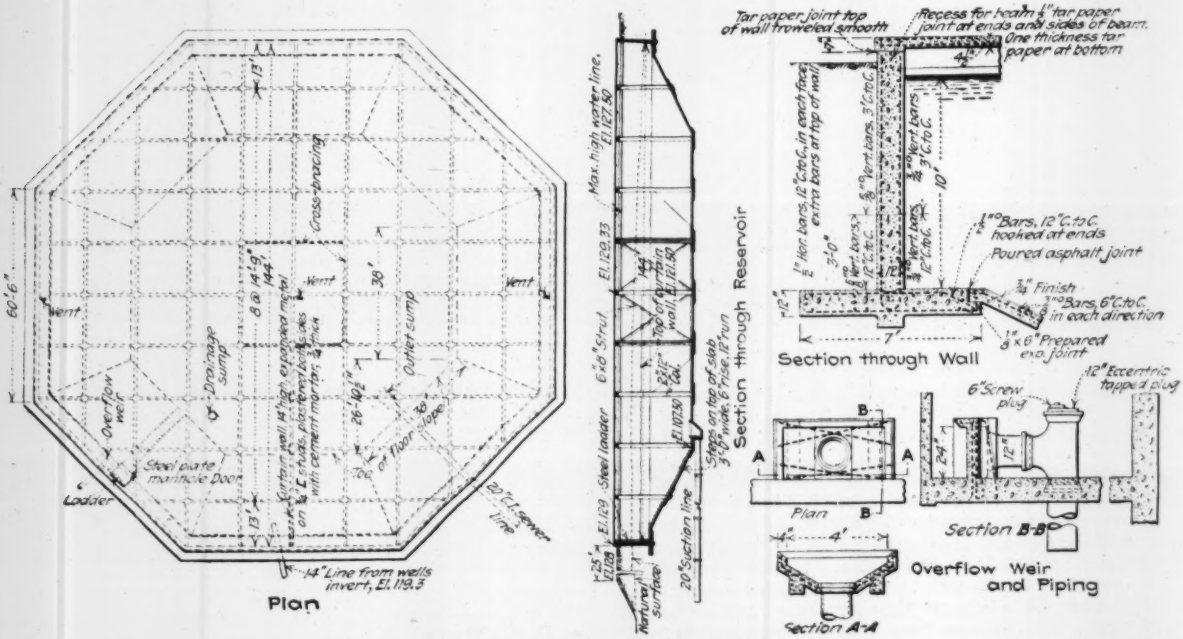
Analysis showed that a reservoir with a sloping bank surmounted by a low wall was more economical than one with a wall the full depth of the reservoir. It was then necessary to determine the proper depth and the best shape for the reservoir. The sloping bank is entirely in cut. The wall is designed to support the backfill with the reservoir empty and to carry the water pressure without placing any reliance on the backfill. On account of the somewhat large area, the expansion in the roof slab will be considerable, and the wall was therefore designed as a cantilever, with an asphalt joint at the roof. The resistance of the backfill was taken as an additional element of safety, and also to provide against certain possible contingencies not considered in the design, such as uplift under the footing and thrust from the expansion of the roof. The base is designed so that the resultant falls near the edge of the middle third.

An extended investigation was made as to the economical depth. It was not necessary to consider the drainage, so that cost alone was the determining factor. On account of the easier analysis, a reservoir of circular shape was assumed, and estimates of cost were made for reservoirs of depths of from 12 ft. to 26 ft. It was found that the cost decreased with the increase in depth until a depth of 24 ft. was reached. The decrease was slight for depths below 20 ft. and that figure was therefore used in the design.

In a comparison between a square and a circular reservoir, it was found that the latter would have 64 ft. less length of wall and would cost approximately $1,000 less than the square reservoir, taking into account the extra cost of forms and columns. Even with this estimated difference in cost, some hesitancy was felt regarding the circular shape, on account of the possible difficulty in building forms and securing a true circle. The octagonal shape then suggested itself as a means of avoiding the more difficult form work required by a circular shape, and upon analysis it was found that the quantities were only slightly greater, and the cost probably slightly less, than for the circular reservoir. The octagonal shape was therefore adopted.

The roof columns and beams were of usual design, the live load being taken as 50 lb. per square foot. On account of the light loading and the height, the columns were designed with a radio of length to diameter of 20.5. The compressive stress over the whole section was 173 lb. per square inch and the stress due to moment caused by unequal loading was 120 lb., giving a total maximum stress of 293 lb. per square inch. The allowable stress by the Los Angeles reduction formula on the columns as designed was 390 lb. per square inch.

The cross bracing at the center of the reservoir was designed to carry the thrust due to an unequal movement of the roof slab under expansion, which could be calculated only approximately. It was assumed that the weight of the slab and live load for half a panel over the projected diameter of the reservoir rests on each of two opposite walls, and that one side sticks and the other slides easily, so that the difference in the coefficients of expansion is 0.5. This is an extreme assumption, and struts designed to resist this stress should carry any load that may come on them.



OCTAGONAL CONCRETE RESERVOIR AT ENID, OKLA.

The bottom slab was reinforced so as to have 0.3 per cent of steel in each direction. The footings under the columns were designed to spread the load from the columns. After the design had been completed the floor was checked as a flat slab by the Chicago code and the stresses were found to be conservative.

The reservoir was designed by Black & Veatch, consulting engineers, Kansas City, Mo. The contract has been awarded to the Smith-Graham Construction Co., of Augusta, Kan.

The Value and Application of a Traffic Census

Extracts From Paper Read Before Seventh Canadian Good Roads Congress By W. A. McLean, Deputy Minister of Highways, Ontario

ROADS should be built for the traffic they are to carry. This is an axiom of road building which cannot be too strongly emphasized; but which by many road authorities has been met in a hazy, experimental manner, and without proper consideration of probable traffic; and the quality of wearing surface, its width, and the strength of foundation adapted to anticipated traffic. As a result, we find single-track gravel roads where double-track roads or a concrete pavement should have been built; and, conversely, asphaltic pavements are rolling and disrupting in idleness where a good gravel roadway would better serve every purpose.

It follows, then, that adequate information as to traffic is desirable as a rational basis for designing the road or pavement which is to serve any given location; and as a basis for determining whether an expenditure of $1,000, $10,000 or $50,000 for any given work, would be justifiable.

The value of a traffic census has limitations which are at once evident. Thus, the amount of traffic which will pass over many roads after construction, may bear little relation to the traffic over the unimproved road. In such cases, it is the potential traffic of a district which should be considered, rather than existing traffic; but definite data, obtained from actual count, is of use in determining the probable traffic which the improved road will be called upon to carry. Thus on the Toronto-Hamilton highway, traffic amounted to from 300 to 700 vehicles per 12 hr. at various points; but with the completion of the concrete pavement, these figures leaped to 2,500.

Potential Traffic Estimate Essential

The potential traffic of a district, preceding the construction of a road, is a matter for careful estimate; just as probable traffic for an electric or steam railway may be based on the population and industries served. A somewhat interesting series of charts was published in the report of the Ontario Highway Department for 1915, a net result of which was to show that not less than 80 per cent of the traffic of the province is carried by 20 per cent of the highways; that 80 per cent of the roads are but lightly traveled, and are such as can be adequately built with a single track of gravel or broken stone. Also that few roads serving a purely rural population would be required to carry a maximum of traffic much in excess of an average of 200 vehicles a day.

Traffic in excess of that amount, except adjacent to the largest cities, may usually be attributed to interurban influences.

Knowing the potential traffic of a district, the highway engineer turns to data of the carrying capacity of various types of road and pavement—a matter in which there is room for much diversity of result. For example, limestone gravel has less wearing capacity than a gravel from trap or granite. The foundation and subsoil have a decided bearing on the case. Roughly, and with scope for such modification, the wearing capacity expressed in vehicles per day, of various materials as used in Ontario, may be broadly gauged from the following schedule:

	Single-horse	Two-horse	Light Trucks or Pass. Cars	Motor Trucks	Total
Single-track gravel	40	15	20		75
Double-track gravel	50	50	100	5	200
Water-bound macadam (single track)	50	30	40		120
Water-bound macadam (double-track)	90	50	100	10	250
Double-track gravel, oiled or tarred	175	75	400	10	660
Double-track macadam, oiled or tarred	200	150	600	10	1,000
Macadam penetration bituminous	200	300	1,000	50	1,550
Macadam foundation, bituminous concrete	200	400	2,300	100	3,000
Bituminous concrete on cement concrete foundation	200	400	4,200	200	5,000
Cement concrete	200	200	4,400	200	5,000

Among the purposes which a traffic census may serve are the following:

1. To determine the traffic importance of one road as compared with another in the same system, and thus to differentiate between different roads as to community value. This data may be useful in laying out a system, especially with a view to granting government subsidies.

2. To determine the traffic value of the same road before and after improvement. Such information is useful in determining the economic value of highway improvement.

3. To determine the increase of traffic on the same road during a period of say five years, by two different censuses. Such data is useful in anticipating future increase in highway travel.

4. To determine character of traffic, whether farm, local between centers of population, or tourist, and thus to arrive at a fair distribution of cost.

5. To determine respective percentages of horse-drawn, passenger car, and motor truck traffic, and by comparing previous censuses to estimate future changes with a view to adjusting type of construction.

6. To determine total gross tonnage passing over a fixed point for a period of 12 daylight hours, in conjunction with the speed at which this tonnage travels, useful data in determining: (a) Amount of wear, including impact and displacement resistance sustained by a certain type of roadway, comparing this with maintenance charge per year; (b) whether such roadway is economically fitted to bear this gross tonnage.

7. To determine the importance of various phases of traffic, and therefrom determine the loadings and speeds which should be permitted; viz, for purposes of traffic regulation.

Modern Traffic Demands

In a review of the road situation in the British Isles and a forecast of what future demands will be made upon the highway designer, Sir Henry Maybury, Director of Roads in the British Ministry of Transport, recently told members of the Institute of Transport at its first meeting that modern traffic demanded, in addition to durable, dustless non-slipping and noiseless surfaces, the following:

1. For its great trunk roads a width between fences of 100 to 120 ft. with possibly a central ballasted tram track screened by trees.
2. Carriageways of minimum camber—say 1 to 30.
3. Improved sight lines at road intersections.
4. Road corners curved to a wide radius.
5. More permanent road surfaces needing less frequent renewals.
6. Rapid access to the great airdromes which will be located at the outskirts of all popular centers and for which town planning schemes will doubtless make provision.
7. Adequate footways to insure the safety of pedestrians, who are now in danger on pathless roads between steep banks.
8. Fewer grade crossings and swing bridges, especially in dock areas.
9. Stronger bridges.
10. By-pass roads to enable the fast traffic to avoid congested areas.
11. Well smoothed-out gradients and the suppression of hogbacks over culverts.

Working of Laws Regulating the Practice of Engineering

Extract from Paper by T. L. Condron, chairman of Engineering Council's Committee on Licensing of Engineers, presented June 21 to Western Society of Engineers

IN ORDER that there may be a clearer understanding of some of the annoyances and difficulties resulting to engineers from registration or license laws, comment will be made on some of the requirements. The clauses providing for issuance of certificates to all engineers practicing in the state when the law goes into effect, may be disregarded here.

In nine states certificates will be issued only to those passing an examination: Colorado, Florida, Idaho, Illinois, Iowa, Michigan, Oregon, Virginia and Wyoming. In most of these states, an engineer holding a license to practice in another state where a similar law is in effect may be excused from an examination. Consequently, regardless of the qualifications that an engineer may have or of his experience or reputation, he must submit to an examination, the character and scope of which is uncertain, before he will be permitted to practice his profession in these states. For instance, in the State of Illinois, a non-resident must have passed an examination in some other state having equal requirements to be exempt from examination under the Illinois law. Consequently, men, eminent in the profession and with many years of successful practice, are required to take an examination in the same manner as those just entering the profession. Efforts are now being made to have this ruling with regard to the Illinois law changed.

Engineers do not find their field of practice limited to a single locality as is generally true for physicians and frequently true for lawyers, but an engineer's practice usually extends over several states. Engineers of reputation are frequently summoned, on very short notice, to advise and pass upon propositions outside of the state in which they reside. It is therefore against public policy to bar experienced engineers from interstate practice because they may not have qualified in each and every state by taking examinations and obtaining licenses in advance of any professional engagement in such states.

To obviate this difficulty, the proposed uniform law of Engineering Council stipulates that a non-resident engineer may legally offer by letter, announcement or otherwise, to practice in the state without first obtaining a certificate. A non-resident engineer may also legally practice not to exceed 15 days in any calendar year without being registered, provided he is legally qualified for such professional service in his own state or country. This clause is intended to cover cases of professional consultation on emergency work.

An equally important provision is made to cover the case of a non-resident or newly-arrived engineer called upon to practice professionally in a state in which he is not registered. He is to be legally permitted to practice after he has filed an application for registration, for such reasonable length of time as the board requires in which to consider and grant or deny his application.

No such provisions as these just outlined appear in most of the registration or license laws now in force in several states, and engineers are certain to find that these laws, if enforced, will cause them embarrassment and annoyance as their practice extends beyond the state in which they are residents.

Engineering Council has not formally approved the uniform law recommended by its committee, principally, I believe, because Council is awaiting the decision of the American Institute of Architects as to whether it will approve or oppose the inclusion of architects and engineers under one registration law. Moreover, the Institute of Mining and Metallurgical Engineers has formally expressed itself as not in favor of the registration or licensing of engineers. It seems to make very little difference whether individual engineers are in favor of such legislation or not, because of the fact that eleven states already have enacted such laws, *and it is now important that the engineering profession unite in demanding uniformity of legislation and the elimination of unnecessarily burdensome requirements.*

Experience With Riveting Snaps in Scotch Shipyards

VAGARIES of performance of construction tools have no geographical limitations. In the January and February issues of its *Transactions* the Institution of Engineers and Shipbuilders in Scotland is found discussing the same problem of breakage of pneumatic hammer riveting snaps that is familiar to the American erector, fabricator and shipbuilder. It is apparent that design, material (and its heat treatment) and handling all have a part in determining the span of life for a snap, subjected as it is to rapid alternations of compression, tension and bending.

Two variations from standard design (which is much the same as the American standard) that had an influence in reducing breakages were (1) a snap head with hole drilled down the center of the shank to a point well inside the head, and (2) the collarless snap, in which the fillet it either greatly increased in radius or eliminated. In Scotland just as in America it is at the fillet that failures almost invariably start. High-grade crucible carbon steel, heat-treated to give a hardened face and end but with the temper drawn from the middle of the shank to afford maximum toughness, is preferred by most of the Scottish shipbuilding men, it seems. Several methods of manipulation in heat treatment were discussed.

The importance of the handling that the tool received was proven by a test in which one lot of snaps was divided between a yard of the Clyde and one on the Tyne. "The former were broken at once, while the latter all worked well. Two snaps from the lot sent to the Clyde were transferred to the Tyne and worked well, while two transferred from the Tyne to the Clyde were at once broken." The most obvious differences in handling were in the "angling" of the hammer and in the amount of play allowed the snap out of the barrel of the hammer. The greater the angle from the axis of the rivet at which the hammer is "rolled" around an imaginary cone in heading up, and the greater the distance the snap is allowed to rebound at each blow, the more severe the strains set up, and the shorter the life of the snap. Cold rivets and insufficient air pressure were factors in increasing breakage, in the opinion of one of the discussors of G. D. Hollis' original paper, who added that the better riveter a man was, the less he rolled his hammer.

Zoning Proposed for San Francisco

A tentative zoning ordinance for San Francisco has been prepared by the City Planning Commission after a year of field work and map preparation under the direction of R. S. Woodward, of the city engineering department. Six zones are proposed. The first would be for single-family dwellings. In the second zone all classes of residences would be permitted, besides various other buildings not considered detrimental to a residence section. The third zone would be commercial, but the same sort of residences as are allowed in zones 1 and 2 would be permitted. Zones 4 and 5 are light and heavy industrial districts, and zone 6 is the slaughter house and generally unrestricted section.

Notes from Foreign Fields

BRIDGE ERECTION IN HONDURAS

By W. T. Penney
General Contractor, Guatemala, Central America

TORRENTIAL floods are perhaps the chief danger to the bridge erector in most South American countries. Since the operation is typical of the conditions and also affords a record of fairly rapid work, the recent erection of a railway bridge in Honduras will be described.

In 1914 the writer entered into a contract with the government of Honduras to erect the bridge at Pimiento, the terminal of what is known as the Puerto Cortez railroad, some 50 miles in length, extending from Puerto Cortez to Pimiento. The bridge consisted of two spans, respectively 450 and 90 ft., and their necessary foundations. It was erected in quick time, taking into consideration the isolated country and the labor employed, which consisted of four American bridge men and some American negroes, together with natives of Guatemala and Honduras.

The Uluea, over which the bridge is located, is one of the largest rivers in Honduras. The water is low and safe for falsework five months of the year, but the balance of the year the stream is a raging torrent, carrying, among other things, immense trees. It behooved me to get my falsework in before the flood period. In making this assertion I know whereof I speak. Some few years ago I erected a number of bridges for the United Fruit Co., in Bocas del Toro, Panama. The camp was some distance from the bridge site. The particular span was 300 ft. long, was erected, pinned, bolted and partly riveted, but not anchored. The falsework was removed. There was a very high rise in the river during the night and when the crew returned in the morning the span had disappeared—left for parts unknown. The drift had completely carried it away.

To return to Honduras: Fortunately both abutments were on high ground, thus permitting us to get them in, and all other preparations made for a quick start when river conditions permitted. The bridge steel, the traveler and the timber for falsework were on the ground and checked out accurately.

The equipment was first class, consisting of two hoisting engines, a steam hammer No. 2, an orange peel dredge and a compressor fully equipped, together with all other necessary tools. The railroad company, luckily, had some good steel flat cars, one of which was promptly appropriated for a derrick car. When this was completed it picked up the 12-ton end posts and the 10-ton top chords. All the work was done with this car with the exception of placing the end posts, raising the top chords and a few of the intermediate posts, which was done with the traveler.

The floor system was placed as the falsework proceeded, thus making one operation and saving timber. The boom of the derrick car was made long enough to drive bents 30 ft. apart. No leads were used. The one river foundation consisted of two sheet pile cylinders, excavated with the orange peel dredge, and concreted with a bottom dump bucket to save unwatering.

The span, luckily, had link and pin bottom chords.

TRAVELER USED ON BRIDGE ERECTION IN HONDURAS

This type of structure saves riveting in a country where riveters are scarce and the climate intensely hot and also permits one to remove falsework as soon as the erection is completed. It is always safer to rivet up rigid bottom chord, especially in a long and heavy span, before removing all the blocking.

As the erection proceeded the span was well bolted and drifted and a few of the important points were riveted, so that when the last connection was made the blocks were split out and the traveler was run back to a safe place, the timber salvaged and the piles chopped off. The river rose a week after removing the falsework.

The spans were fabricated by the Edgemore plant of the American Bridge Co., and the work was well done. Every clearance was perfect, and there were no interfering or badly arranged countersunk rivets to contend with. The iron was properly assembled for transportation; the chord bars bolted in bundles of four and each pin separately and strongly boxed. Rivets, bolts and small pieces came through intact, not a box broken. Let it be noted here that in shipping bridges to foreign countries it is essential to have pilots and driving caps for all pins, "slathers" of bull pins, fitting-up bolts and washers, and to see that they go on the first shipment.

Automatic Cement Briquet Testing Machine

A new automatic cement testing machine, known as the Olsen-Boyd automatic cement tester, is described by T. Y. Olsen in a paper presented before the recent meeting of the American Society for Testing Materials. This machine substitutes for the usual shot flow a cylinder filled with liquid which operates to move a needle on a dial during the automatic application of the load. When fracture occurs the needle stops and the breaking load is read directly from the dial.

LETTERS TO THE EDITOR

Definition of Engineering Needed as Basis for License Laws

Sir—The agitation which has been in progress for many years past concerning the necessity for some form of license law, and which has crystalized into legal enactments in some states, has provoked much discussion as to what engineering really is. In those laws which are now in force definitions differing from one another in many ways are set forth. It is evident that any law which prescribes rules and regulations for the practice of a given profession, and which does not clearly define what that profession is, will lead to much confusion.

We are led to believe, however, that in the case of engineering this definition should be negative rather than positive, for it is much easier to say what engineering is not than to express in set phrases exactly what it is, and, furthermore, when a definition of engineering is enacted into law, that at once puts a limit, at least legally speaking, upon the practice of that profession. If the definition must be positive, and perhaps legal form would require that, let it be in general terms which, while they set forth clearly the sphere of engineering, are yet elastic enough to include all forms of engineering activity.

The following definition has appealed to the writer as coming nearest fulfilling the foregoing requirements: "Engineering is the Science and the Art of Design." It is a science because it constitutes a body of systematized knowledge and it is an art because in its practice it is the application of the principles of science. The sphere of engineering is that of design, planning that which is to be done in accordance with the principles of science and setting forth that plan in a set of drawings and specifications. When that is accomplished the work of engineering is done. What follows or preceeds falls without its sphere.

Perhaps the commonest error in regard to engineering is to confuse it with surveying. "Surveying is the Science and the Art of Measurement." A comparison of this definition with that above given for engineering will disclose that, while closely related in practice, they have nothing at all in common in principles. We do not, of course, mean that surveying is in any sense an easy or a limited sphere, but it shares nothing with engineering, save perhaps the element of precision. The engineer may survey and in most cases he has to use the results of surveying, but in making a survey he is not doing engineering work, and in order to be an engineer it is really not necessary that he know anything about surveying. A lawyer may be a stenographer and he uses the results of stenography, but we should not therefore confuse stenography with law. Yet that is just what happens in the popular mind in the case of engineering and surveying. To be an engineer, to the layman, means nothing more than the ability to do a little land surveying. As absurd as all this is, it is deep rooted in the popular mind and will have to be reckoned with in any attempt to secure the enactment of an engineering license law. The writer speaks from his own personal experience on this point.

Another common error, particularly in the South, is mistaking the engine-driver for the engineer. This may seem like hair-splitting, but it will be found to be vital in framing any form of engineering license law. Its neglect will lead to inevitable confusion and defeat of the real purpose of such a law.

A third common error is mistaking the contractor for the engineer. It is here that the greatest obstacle is encountered in framing a license law for engineers, for great care must be exercised not to confuse the two and to exclude completely from the operation of the law the work of construction. A contractor builds what the engineer designs. The relationship is very like that existing between the druggist and the doctor. The druggist fills the prescription which the doctor writes.

Engineering work ceases when the plans and specifications are wrought out. So very clear is this distinction that a distinguished writer upon railroad engineering, A. M. Wellington, defines an engineer as one who does not build. Scientifically speaking, this is really not a definition at all, but, as Mr. Wellington evidently intended, it brings out very strikingly the distinction we are presenting here, and one which is of very large importance in the framing of any form of license law.

WALTER H. DRANE,
Chief Engineer,
Smith County (Tenn.) Highway Commission.
Lebanon, Tenn.

Señor Ibañez and His Reference to Engineers

Sir—I think Emile Low is unduly exorcised over what he seems to think is the disesteem in which the engineer is held in Mexico, as revealed to him by the articles of Señor Blasco Ibañez. Apparently he takes exception to the preface of the title "engineer" to the name of the person in the case cited, Sr. Bonillas, ex-Ambassador to the United States.

It is customary in all the so-called Latin countries, France, Italy, Spain, etc., and countries where the Latin languages are used, to preface the name of an engineer with the title of his profession, just as they do that of a lawyer and as we do a Doctor of Medicine. A lawyer, for instance, is generally referred to as "Licenciado" or often as "Doctor."

Mr. Low may, I think, rest assured that not only are engineers fully appreciated in Mexico but there, as in almost all countries outside the United States, they are accorded the distinction given to all learned men, if they be such, due to their professional attainments and their supposed or expected superiority over men of ordinary education and learning.

By the bye, the articles referred to, of Sr. V. Blasco Ibañez, are among the best, if not the very best of their kind, as they not only vividly but most accurately describe the conditions in Mexico and are extremely well worth reading.

F. LAVIS,
New York City. American International Corporation.

Wanted: To Define Engineer's Duties on Cost-Plus Work

Sir—I wish to submit to you a question which I hope you will answer through the columns of your magazine. This problem has been the subject of considerable discussion recently, and I believe that other readers may be interested enough to express their opinions. Briefly, the problem concerns the respective duties of the owner, engineer and contractor on the various classes of contracts now in use. To make my meaning clearer I will give a few typical examples:

First, in nearly all cases there are three parties to the contract, i.e., owner, engineer and contractor. The term "engineer" is intended to include the "resident engineer," and it is with his duties that I am chiefly concerned. The most obvious duties of the resident engineer are those of furnishing the lines and levels required for the construction work, and acting as an inspector, passing judgment upon the quality of material and workmanship embodied in the structure. These matters are usually covered at great length in the specifications. But now comes the more difficult problem of defining just where the responsibility of the resident engineer ends, and that of his superior engineer begins, and also the extent to which the engineers can go in dictating to the contractor as to how he shall manage his organization and generally conduct the job.

It is at this point that the form of contract begins to have an influence. In the lump-sum contract wherein the contractor agrees to furnish all material and labor to complete the work for a fixed sum, he stands to make or lose money entirely upon his ability to do the work economically and keep the cost within his bid. The owner has nothing to lose if the job actually cost twice the amount of the contract. Also the engineer merely is required to see that the contractor fulfills the specifications. In this case, is it not true that it is none of his business how the contractor organizes his forces and conducts the work, provided that the final result is according to the plans?

Upon entering the present period of uncertainty regarding prices of labor and materials, the percentage contract was devised for the purpose of protecting the contractor against losses due to rising prices and, also, to protect the owner against the wide margin of profit included in the item for contingencies that a contractor was sure to add to a lump-sum bid in order to protect himself. It is here that the duties of the engineers begin to be enlarged. Is it not true that the resident engineer is now expected to protect the owner against all inefficient methods of working, and insist upon having first-class equipment in the contractor's outfit, and that he employ only such methods of construction as will produce the lowest possible unit costs? Assuming this to be true, where can the line be drawn defining the powers of the engineers, as against those of the contractor? In this case, should the resident engineer have full responsibility for the management of the job, or should he merely act as an inspector as in a lump-sum contract? How can he, knowingly, stand by and see the contractor waste the owner's money in inefficient methods, when he is morally bound to protect the interests of his client? On the other hand, what authority can the superintendent of a job have over this organization if he knows that any, of all, of his orders may be countermanded by the resident engineer?

I would like to have an opinion from the editor or a discussion by the readers with the object of defining the duties of the inspector, resident engineer, and engineer-in-chief with regard to contracts of the percentage or cost-plus-a-lump-sum-profit type in which both sides of the question are fairly set forth.

Milton, New Hampshire. H. M. BRYANT.

The Importation of Chinese Labor

Sir—Serious consideration should be given the question of importing Chinese labor to relieve the shortage, which, by the Government's own statistics, is placed at from 3,000,000 to 4,000,000. To be able to coax a few million Americans into becoming laborers would be ideal, but what success would we have in peace time when during the war the laborers' patriotic zeal led them to graduate into the mechanic class and threaten industry with one strike after another? Undoubtedly we could find enough Americans of pioneer stock who are physically able to do that kind of work, even if we had to go back to the clam-digging Smiths of Long Island, but if we take them away from their job who is going to dig clams. Unfortunately there is no law compelling a man to work at some productive occupation. If there were, we could probably raise an army of 10,000,000 laborers from among the parasites who are living on other people's brains and brawn.

The suggestion of bringing in Chinese labor should have been taken up seriously several years ago. To overcome the prejudice of the public against the yellow race will require years of educational activity. The average citizen puts Chinese and Japanese in the same class; and how many Americans are there who can find China on the map? Does the average American know that a Chinese is a good laborer, and that the Japanese and not the Chinese are the real offenders on the western coast?

Education of the press should also be taken up, for if the press continues to feed us with misinformation there will be no education of the public.

Election of legislators who cannot be controlled or threatened by organized labor is also necessary. The labor unions will undoubtedly put up a strong fight against any legislation tending to modify the Exclusion Act.

The American Society of Civil Engineers should help a movement such as Mr. Ericson has started, and if he succeeds in awakening that society from its lethargy he is entitled to a place in the hall of fame.

Rockville Center, N. Y. WALTER G. FEDERLEIN.

Sir—Mr. Ericson, in *Engineering News-Record*, May 6, p. 927, brings out the point that the present shortage of labor and the resulting exorbitant prices threaten to postpone large engineering projects now under consideration to the detriment of our profession, a danger which a modification of our legislation in regard to Asiatic immigration would obviate.

This is undoubtedly true, and I fully agree with Mr. Ericson that American engineers should use their influence in this direction. But there is, beside the advantage this country would gain by utilizing Chinese labor, a very important feature of this problem to be considered on which so far little stress has been laid.

China in its present backward condition, without adequate means of transportation, with a lack of sanitary works, power development, etc., and, on the other hand, with undeveloped resources of a magnitude unsurpassed by any other nation, offers an unparalleled field to the American engineer. It is therefore, aside from any consideration of fairness and justice, to our interest to cultivate friendly feelings with the Chinese Republic. China owes a debt of gratitude to the United States for having generously canceled the indemnity for the Peking expedition, and just now we are, in concert with the other great powers, on the point of giving her financial aid, so the Chinese people would undoubtedly welcome the American engineer and appreciate his work if it were not for the feeling of bitter humiliation intelligent Chinese must feel when they see that we look down on their nation and shut the door on their fellows. How far such feelings would influence the employment of American engineers in China or reduce their usefulness, how far they would favor the employment of English or Japanese engineers in preference to Americans, we cannot tell, but, no doubt, the antipathy and prejudice thus produced would make itself seriously felt.

A more liberal policy in regard to Chinese immigration will be of great benefit to us, not only in our own country, but also on the other side of the Pacific; the work of modernizing the Chinese Republic by the assistance of the American engineer will then begin under the brightest prospect. We welcomed the work of a hundred thousand Chinese laborers behind the trenches in France, why not welcome their help here? Let's open the door—the wider the better.

St. Louis, Mo. CARL GAYLER, C. E.

Engineers in Massachusetts Civil Service

Sir—Under slavery, the negro's desires, hopes and ambitions were rarely ever considered when the swapping and selling of negroes began. If the negro desired to change his job, for one on another plantation, it was his privilege to "desire" a transfer as much as he pleased, this privilege being allowed simply because there was no way to control his thoughts. But an actual change, or transfer, could not be accomplished except by agreement between the plantation owners.

The Massachusetts Civil Service Commission still adheres to the obnoxious rule and practice of not permitting the transfer of an employee from one department to another except by agreement between the employing officials. Consequently the opportunity for advancement of civil engineers under civil service is controlled entirely by employing officials and the Civil Service Commission. Without "kow-towing" to his employer, an employee has absolutely no opportunity, consideration or redress in the matter of transference from one position to another.

A short time ago, an employee was not only denied the right to accept another position, but was also abruptly discharged from the position he held for daring to attempt to better his position. Apparently the opinion still holds that the right to accept another public service position is anybody's business except that of the employee.

Under the laws of Massachusetts, physicians, optometrists and lawyers are required to pass the State examinations only once in order to practice their professions, but in the same State civil engineers must pass State examinations every two years if they wish to be listed as engineers qualified for public service. At least, that procedure is required by law although it is violated. Under this condition the lack of applicants for professional examinations is understandable and the dearth of competent eligibles is a natural result.

THOMAS N. ASHTON,
Fall River, Mass. Civil Engineer.

HINTS FOR THE CONTRACTOR

Cable Erection and Tower Details for Chuting Plant

TO PREVENT eccentric tower loading by the chute suspension cables, in the case of the building plant layout shown by Fig. 1, special tower top details and special methods of stretching and fastening the cables were adopted. Two cables were employed to provide independent suspension for the chute systems on the right and on the left of the center tower. Each cable was 1⅜ in. in diameter and had a span between deadmen of about 715 ft. As indicated by the lettering of the cables, the line which carried chutes on each side of the center tower was drawn taut on the opposite side. This prevented any intermittent strain on the center tower from "take up" in the cable when concrete was flowing in the chutes.

To avoid eccentric loading of the tail towers, the tower top framing shown by Fig. 2 was employed. The load on the center tower being symmetrical no special framing was required. With the taut and slack line arrangement, however, and because of the size and length of the cables, the problem of stringing and fastening the cables required special solution. First, the two cables were strung over the three towers down to the anchors. Next, they were clamped together at the center tower with eight 1⅜-in. cable clamps and then fastened to the center tower with two large U-bolts. Then the tight cables on either side of the center tower were pulled as nearly taut as possible with two triple blocks having a pull of about 12 tons; the taut and slack cables were then clamped together at, and U-bolted to, the top of each tail tower. Finally, the two cables at both ends were pulled as nearly taut as possible from the tail towers to the anchorages.

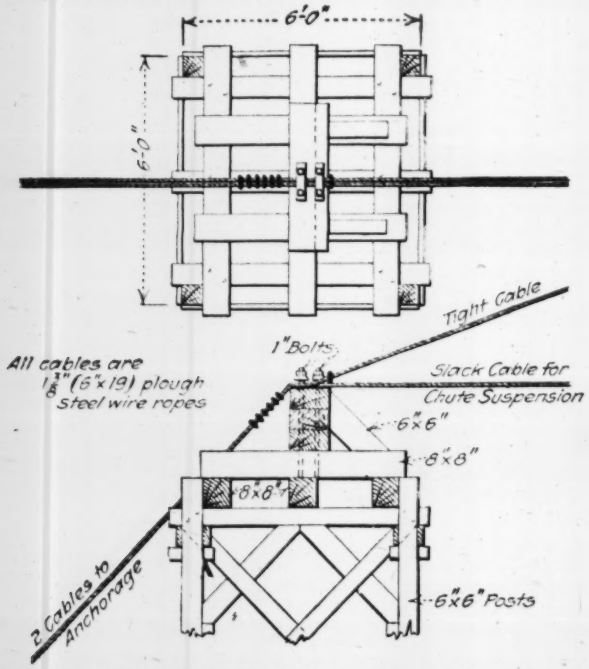
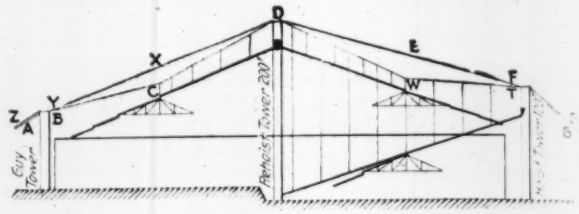


DIAGRAM OF SUSPENSION CABLES AND CHUTE SYSTEMS



TAIL TOWER HEAD FRAME

Some sag remained in the taut cables, following the procedure described. To remove this sag, counterweight chutes were suspended complete from the slack cables on both sides of the center tower. Then the cable clamps at the top of the center tower were gradually loosened and simultaneously the chutes were hoisted. When all the weight of the chutes was taken by the slack cables and the sag was pulled out of the taut cables the loosened clamps were refastened.

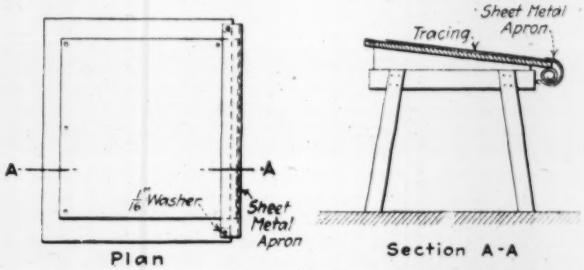
The M. J. Hoffman Construction Co., Indianapolis, Ind., were the contractors for the building, constructed for the Haynes Automobile Co., upon which the above described system was used.

Drafting Board Apron To Prevent Rubbing of Tracing

BY RALPH G. FOCHT

Structural Engineer, Washington, D. C.

REFERRING to sketch on p. 929 of your issue May 6 showing a half-round piece attached to the edge of a drawing board to protect drawing from creasing: Such a device affords only partial protection to the tracing. The tracing will be rubbed by the clothing of the draftsman while he works over the drawing and if the tracing is long, as with maps full size drawings and like, it will extend to the floor. A bent piece of sheet metal or apron as shown herewith overcomes these objections at a small cost. This apron may best be made of sheet brass although a section of hanging gutter as used in house construction may be substituted. The section should be quite heavy to prevent bending when the draftsman bears against the board. Attention is also called to the fact that the apron prevents pencils and pens from rolling off an inclined board.



Another handy appurtenance to a drawing board is a piece of oil cloth mounted on an ordinary window shade roller, and attached to the top of the drawing board so that the drawing may be covered up at night, thus preventing dampness and warping of the drawing.

NEWS OF THE WEEK

New York, July 1, 1920

Compensation Committee Reports to Engineering Council

In its progress report to Engineering Council, presented at the meeting of June 17, by Chairman Arthur S. Tuttle, the Committee on Classification and Compensation of Engineers makes the following statements regarding the report of the Congressional Joint Commission on the Reclassification of Salaries.

"The classification of engineers proposed by the Congressional Joint Commission on Reclassification of Salaries shows that the work of this Commission has been guided largely by the work of your committee, and a comparison of its recommendations with those of your Committee will be shortly released for publication. It is the belief of the Committee, that, to say the least, the Federal Commission's classification, where it differs from that of your Committee, has no advantage. The compensations for the various positions proposed in the Federal report are disappointing as they do not provide anything like the increases which are believed by your Committee to be essential to the end that the engineering profession may attract and retain men of proper calibre to assume successfully the responsibilities placed upon it.

"From the analysis it would appear that in the lower grades of Federal service in 16 bureaus the compensations proposed by the Congressional Commission would be from 2 to 19 per cent less than those which have heretofore prevailed, while in the higher grades the increases range from 8 to 17 per cent. The proposed salaries other than those for the grade 'Junior Assistant Engineer' range from 20 to 30 per cent less than those suggested by your Committee."

Discussing work to be undertaken, the report states: "It is proposed to undertake a vigorous campaign for the purpose of securing recognition of the classification of various positions as recommended by the Committee last year and as adopted by Council on December 18, 1919, and at the same time to secure a general expression of opinion on the part of engineers and heads of services as to the compensation schedule tentatively suggested by the Committee."

In addition to addressing communications to the secretary of each of 123 engineering societies in the United States and Canada, arrangements are being made to secure co-operation on the part of the lay as well as the engineering heads of all services employing engineers and of all Civil Service Commissions.

Engineering Council Endorses Federated Societies

At its regular meeting June 17, after hearing a report on the Organizing Conference of engineering societies held in Washington, D. C., June 3 and 4, Engineering Council took the following actions:

Voted: that Engineering Council heartily endorse the plan of organization of the Federated American Engineering Societies and the American Engineering Council, adopted by the Organizing Conference of technical societies in Washington, June 3 and 4, and authorize its Executive Committee to proffer and perform on the part of Council such assistance as may be practicable in completing the work of the Organizing Conference and of the Joint Conference Committee of the Founder Societies in establishing the American Engineering Council.

Voted: that Engineering Council authorize its Executive Committee to deal with any question of co-operation with the Joint Conference Committee of the Founder Societies, relating to the permanent organization of the Federated American Engineering Societies, which may come up during the summer.

Voted: that the Secretary be instructed to invite to future meetings of Engineering Council delegates of the societies participating in the Organizing Conference in Washington, June 3 and 4, and editors of technical journals who may be interested.

No Cement for Street Repairs in Washington

Inability to secure shipments of cement has stopped all repairs on streets in the District of Columbia. A large amount of work, which is half finished, must stand in that shape for an indefinite period, it is predicted.

Delaware to Build Asphalt Instead of Concrete Highways

After having placed under contract approximately half of its concrete road construction program the Delaware State Highway Department, unble to secure cement shipments, has decided to complete its 80-mi. hard-surface highway program by the construction of roads with a bituminous foundation and asphalt wearing surface. This decision was reached at a conference held between the department's chairman and chief engineer on June 21.

The original program consisted of approximately 80 mi. of concrete highway, either of a concrete wearing surface or a concrete foundation with bituminous or asphaltic wearing surface, but the demand for completed roads and the condition of cement shipments has made it necessary to cancel that program. Inasmuch as no difficulty has been experienced in securing asphalt and stone, it was therefore agreed that the program should not be held up. Plans are now being completed and proposals will be called for about the middle of August for the construction of the 40 mi. of asphaltic road.

Architects Join Engineers in State Federation

New Minnesota Body the Result of Action of 200 Members of Local Engineering Organizations

Co-operation between architects and engineers in Minnesota is assured by the action taken at a joint meeting of members of the two professions, held in Duluth, June 19. The meeting was attended by about 200 engineers and architects, representing the five local engineering organizations of the state and the state chapters of all the national engineering and architectural societies.

Max Toltz, president of Toltz, King & Day, Inc., consulting engineers and architects, St. Paul, and past vice-president of the American Society of Mechanical Engineers, was chairman of the meeting. Frederic H. Bass, professor of sanitary engineering, University of Minnesota, and director of the American Association of Engineers, acted as secretary. W. C. Armstrong, chief engineer of the St. Paul Union Depot Company, chairman of the committee on organization, presented its report in the form of a resolution, which was adopted without substantial change after about three hours of spirited debate. The essential features of the resolution follow:

1. That a state federation of engineers and architects be organized in Minnesota whose membership may embrace all engineers and architects of the state.
2. That the organization be formed by the federation into one body of the Minnesota Surveyors' and Engineers' Society, the Engineers' Club of Minneapolis, the Engineers' Society of St. Paul, the Duluth Engineers' Club, Minnesota Chapter of American Institute of Architects, the Engineers' Club of Northern Minnesota, and such other independent and autonomous clubs, or societies of engineers or achitects, now existing, or hereafter formed, such as autonomous sections of national engineering societies, which may be found eligible.
3. That each federated club or society shall maintain its identity and shall not be restrained, by reason of such federation, from carrying on such technical, welfare and social work locally as it may choose.
4. That the existing Joint Engineering Board shall constitute the first board of directors of the state federation and shall so serve until the new board of directors created under the constitution and by-laws to be adopted shall be formed. Thereafter the board of directors of the state federation shall assume all the functions of the present joint board, and such additional powers as may be conferred upon it by the constituent societies.
5. That a general meeting or convention of the state federation be held at least once a year for technical, welfare and social work.
6. That the state federation be divided into sections representing architecture and the various branches of engineering, such as civil, mechanical, electrical, mining, etc., for promoting technical discussions in these respective branches at the annual convention.
7. That the state federation assume the publication of "The Bulletin," maintain an office and employ a secretary-editor, with such clerical forces as may be necessary.

(*Continued on p. 44*)

Committees Named for National Research Council

Plans have been completed for active work on the part of the division of engineering of the National Research Council. The personnel of the various committees comprising this division has just been announced. The chairmanship of the engineering division is held by Dr. Comfort A. Adams, Lawrence professor of engineering at Harvard University. He now is on leave giving his entire time to this work.

The division has been organized with the co-operation of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society for Testing Materials, the Society of Automotive Engineers, the American Society of Illuminating Engineers and the Western Society of Engineers. In addition, the division works in close affiliation with the Engineering Foundation. The personnel of the division is composed of officially appointed representatives of these societies, together with twelve members at large. The work of the division proceeds under the direction of twenty committees on different special subjects. The work is confined as much as possible to problems of immediate importance to industry. The committees and their personnel, which will deal with subjects of interest to civil engineers, are as follows:

Committee on Economic Theory of Highway Improvement — T. R. Agg (chairman), professor of highway engineering, Iowa State College, Ames, Iowa; C. A. Baughman, R. B. H. Begg, L. E. Conrad, H. S. Fairbank, D. C. Fenner, R. B. Gage, H. J. Hughes, Mark L. Ireland, A. N. Johnson, H. J. Kuelling, H. J. MacIntire and R. W. Schoreder.

Committee on Structural Design of Roads — A. M. Goldbeck (chairman), engineer of tests, Bureau of Public Roads, Washington, D. C.

Committee on Tests and Properties of Road Materials — H. S. Mattimore (chairman), engineer of tests, Pennsylvania State Highway Department, Harrisburg, Pa.; R. W. Crum, H. J. Hughes, F. C. Lang, Morton Owen Withy.

St. Lawrence Waterway To Be Boomed at Detroit

The Great Lakes-St. Lawrence Tidewater Association, with delegates from fourteen middle and northwestern states will have a three-day meeting at Detroit, July 22-24 to boom the projected St. Lawrence River power and navigation development. In addition to many addresses on the commercial desirability of the project, mainly by men of political prominence, there will be several papers on the engineering features of the scheme. These will include, "The Railroad Point of View" by W. L. Ross, of the Toledo, St. Louis & Western R.R.; "Terminals, Transfer Costs and Coastwise Trade" by R. S. MacElwee, of the Department of Commerce; "Navigation and Waterway Commerce," Maj. Gen. L. H. Beach; "St. Lawrence Power Possibilities," Gardner S. Williams; "Port Facilities," by Charles Evan Fowler.

Tents for Canadian Engineers During Open-Air Convention

The Calgary Branch of the Engineering Institute of Canada will hold a meeting at Banff Aug. 14-18. The committee in charge has arranged with the Government for the use of military bell tents, with cots, mattresses and blankets provided, and will serve meals in camp. Visitors are requested to bring bedlinen and towels. Any one wishing to make reservation at hotels is at liberty to do so. The camp will be located near the Banff Springs Hotel, on the Bow River, within five minutes' walk of the golf course. It will accommodate those who arrive the night of Aug. 13 and meetings will begin Aug. 16. The committee extends to all engineers interested, and particularly to those who will be returning from the Portland convention of the American Society of Civil Engineers, a cordial invitation to attend this open-air meeting and bring their families. Notify F. E. Emery, secretary, Western Professional Meeting, care of Gorman, Clancey & Grindley, Calgary, not later than July 25 as to tent or hotel accommodations.

Colorado Petitions for Tunnels

An initiative and referendum petition has been completed in Colorado asking for a vote on an amendment to the State constitution which will provide for the construction of the three summit tunnels described in *Engineering News-Record* of April 8, 1920, p, 716. This amendment provides for a bond issue of $18,550,000 for the construction of the Moffat, Monarch and San Juan tunnels, which are to be owned by the State and are to be of such size as to permit the passage of trains, automobiles and army trucks. Railways refusing to make operating contracts may be required to use the tunnels by order of the State Railroad Commission, which Commission may bring suit to enforce such order. Although over 16,000 signatures were required, the petition was initiated and completed in less than thirty days and was ready some time before the date for filing, July 1. The vote will be taken in November.

Canadian Water-Works Section, with 100 Members, Formed

At the Montreal convention of the American Water Works Association, June 22 to 24, a Canadian Section with about 100 members, was formed. The following officers were elected: Chairman, Alexander Milne, St. Catherines, Ontario; vice-chairman, F. H. Pitcher, Montreal; secretary-treasurer, H. G. Hunter, Montreal.

Architect-Engineer Merger

(*Continued from p. 43*)

8. That the expenses of the state federation be defrayed by a per capita tax on federated clubs and societies, provided that there shall be no duplication of payments by reason of individuals belonging to more than one federated society.

9. That the present Joint Engineering Board together with a committee of one member from each of the societies represented at the meeting or invited to it, who shall be appointed or elected by each of the respective societies, be constituted a committee on organization, to draw up a constitution and by-laws, and prepare all details necessary to carry into effect these resolutions.

10. That this conference fix the time and place for another conference at which the committee on organization shall report and the organization be perfected and put into effect.

The meeting refused to take any action on the method of election of members to the board of directors of the proposed federation that would tie the hands of the committee that will draw up the proposed constitution and by-laws; but a motion carried that it was the sense of the meeting that the board should be composed of delegates elected by the constituent societies in proportion to the members paying their per capita tax through said society.

Discuss Membership Qualifications

The greatest part of the discussion took place on the clause enumerating what societies should constitute the proposed federation. One faction contended that only local independent organizations should be allowed to federate, holding that every engineer and architect should, from personal pride, be a member of such organizations; the other division held that a man should not be forced into a local society against his personal desires in order to become a member of the state federation. Considerable doubt was expressed as to the autonomy, in state affairs, of the local branches of the national societies. The Minnesota Chapter of the American Institute of Architects, however, was recognized as being an independent local organization, being affiliated with the Institute for action in national affairs only.

The Minnesota Joint Engineering Board met in Duluth the morning before the convention, voting to admit the state chapter of the American Institute of Architects to membership. This action, together with the co-operation of the architects in the afternoon meeting and the assurance that they will join with engineers in the state federation, is regarded as a big step toward professional unity in the state and forecasts the presentation to the state legislature of a license bill, modeled after the one prepared by the committee of Engineering Council.

The entertainment provided for the visitors by the Duluth Engineers' Club, consisted of a forty-mile trip around the city by automobile, a dinner dance in the evening, attended by about 250, and a boat trip up St. Louis River to Fond du Lac and return on Sunday morning.

Prof. Hughes New Engineering Dean at Harvard

Hector James Hughes, professor of civil engineering, Harvard University, has been appointed dean of the Engineering School, succeeding Comfort A. Adams, who recently resigned to become chairman of the Division of Engineering of the National Research Council. Dean Hughes graduated from Harvard with the degree of A.B. in 1893 and received the degree of S.B. from the Lawrence Scientific School in 1899. During this period of five years he worked part of the time in the office of the town engineer of Brookline, Mass. In 1899 he joined the Chicago, Burlington & Quincy R.R. as assistant engineer, maintenance of way at Chicago, and the following year was made resident engineer of that road at Burlington, Iowa, in charge of construction. Two years later he was for a short period designer with the American Bridge Co., Pittsburgh.

In 1902 Dean Hughes was appointed instructor in civil engineering at Harvard, from 1903 to 1913 he was assistant professor, during 1913-14 associate professor and he has been professor since 1914. For many years Dean Hughes has been the head of the Harvard Engineering Camp at Squam Lake, N. H., where summer courses in surveying, topography, railroad location, etc., are given.

Arlington (Va.) Sanitary District

At the last session of the Legislature of the State of Virginia a bill passed creating a Sanitary District of Alexandria County, Virginia, and providing for water and sewerage districts to be known as "Arlington Sanitary District."

The three members of the Board of Supervisors of Alexandria County are designated as the Sanitary Commission and are empowered to divide the county into sub-districts upon application of a certain number of qualified voters in one or more of said districts. The board is authorized to make surveys, investigations and estimates of cost for water supply and sewerage and if authorized by a majority vote in the district to issue bonds and have the same constructed and the cost assessed against the district in which the immprovements are made.

David J. Howell, senior member of the firm of David J. Howell & Son, civil engineers with offices in the Union Trust Building, Washington, D. C., has been appointed by the Board of Supervisors of Alexandria County, Va., acting as the Sanitary Commission, as the Chief Engineer of "Arlington Sanitary District."

Mr. Howell is also the general manager of the Alexandria Water Company and his firm as the engineers of this company constructed their large Barcroft dam and storage reservoir and filtration plant.

Mr. Howell, as one of the engineers under the "Board of Engineers on Deep Waterways," had charge of the surveys and investigations on the Eastern Division of the Oswego-Mohawk Route through New York State and was also the engineer in charge of the surveys, investigations, estimates and report of the Barge Canal under Edward A. Bond, State Engineer of New York. His firm has had an extended practice in municipal matters since its establishment in 1887.

To Examine Civilian Engineers For Navy Commissions

In order to fill about 30 vacancies in the commissioned grade of assistant civil engineer, Corps of Civil Engineers, U. S. Navy, with the rank of lieutenant, junior grade, applications are being received by the Bureau of Yards and Docks, Washington, D. C., from candidates who desire to take preliminary and physical examinations for these commissions. The preliminary examination is to determine the general fitness of the applicant, based on papers submitted covering college record, testimonials, references and professional experience. The candidate is not required to report in person for this examination. Those who qualify in the preliminary and physical examinations (physical examination by a board of medical examiners will be made of those who qualify in the preliminary examination) will take the final oral and written examinations at Washington.

The candidate must be an American citizen, between the ages of 21 and 34, and must have received a degree in engineering from a recognized college or university. He must also have had not less than a year's practical and professional experience after graduation. The annual salary begins at $3,200, with increases up to $9,600, depending upon length of service, and promotions.

Progress On Philadelphia-Camden Bridge Project

(Special Correspondent)

Latest developments give hope of some early progress of the project for a Delaware River bridge to connect Philadelphia and Camden. Hitherto virtually no headway was detectible, in spite of the fact that all New Jersey legislation affecting the highly popular Hudson vehicle tunnel enterprise was so drawn as to refer equally to the Delaware bridge. In magnitude this latter undertaking would rival the East River bridges; in fact, if it should be necessary to keep the piers outside the harbor lines an even greater span would probably be required.

After the organization meeting of the New Jersey-Pennsylvania bridge commission, held in December, 1919, nothing has been done, despite persistent prodding by the Philadelphia and South Jersey members. Now it appears that the next move lies with Governor Sproul of Pennsylvania, head of the joint commission. The situation was cleared up considerably recently by a hearing before the bridge committee of the Philadelphia city council, although there developed a somewhat acrimonious discussion between the council members and certain New Jersey commissioners who had the hardihood to tell the Philadelphians that it was they who were holding up progress.

The hearing was on a bill sent to council by Mayor Moore, the effect of which would be to commit Philadelphia to its proportionate share of the cost of the bridge as Pennsylvania and New Jersey have already been committed by state legislation. The council took the stand that it could not pledge the city's credit to the task until the cost should be known; previously the wildest guesses, inspired and uninspired, had been current in the Philadelphia press. It had been stated that if the council would not appropriate funds until it knew what the project would cost, and if the commission could not determine cost until it had funds, there could be no progress. At the hearing, however, the city solicitor stated officially that an initial appropriation of $250,000 made by the 1919 council did not lapse and is available, together with an equal sum appropriated by the Pennsylvania legislature and twice as much appropriated by New Jersey for investigation and construction. Also the representatives of the auditor generals of both states made it clear that the city has until June, 1921, to match a further appropriation of one and a half millions by the states, by finding an additional half million itself.

At the end of the hearing council members stated that it was up to the bridge commission to present its estimates and designs, an opinion that seems to have been concurred in by the press and the citizens generally. Governor Sproul is the one to issue the call to the commission, and now that the national Republican convention is out of the way there is good reason to expect that the bridge will be the next order of business at Harrisburg.

Motor Traffic Laws and License Fees Subject of State Survey

Under the provisions of an act passed by the present legislature, Governor Edwards has appointed a special commission to survey the motor vehicle traffic laws and the motor vehicle fees of New Jersey, with a view to supplementing legislation relating to traffic and fees. The commission consists of State Highway Engineer William G. Thompson, Motor Vehicle Commissioner William L. Dill, Senator Thomas Brown, of Middlesex County; Assemblyman Henry G. Hershfield, of Passaic County; and Horace A. Bonnell, of Newark. Mr. Thompson's resignation as chief engineer of the highway department, takes effect on July 1 and his place on the commission will be filled by Watson G. Clark.

Court Upholds Engineers in Drainage Case

Drainage projects in Illinois may be abandoned on payment of "court costs," and the Supreme Court has given a decision to the effect that these costs must include the fees of engineers and attorneys. In the case of the Cane Creek Drainage District, the lower court of McHenry county held that the fees were not a part of the court costs necessary to be paid in order to permit of abandonment. The action of the lower court is reversed by the Supreme Court, which declares that the order deprived the men of their rights under their contracts with the commissioners as engineer and attorney for the district. Engineers can now undertake drainage work in Illinois without fear of losing their time and pay because property holders decide not to proceed with the project.

Hydro's Chippawa Canal Work Shut Down by Strike

As the result of a protracted dispute over wages and hours the men employed on the construction of the Chippawa Canal, around Niagara Falls, by the Ontario Hydro-Electric Power Commission, went out on strike on June 16. They were receiving 40c. per hour for an 8-hr. day and 60c. for overtime. The commission offered a new scale of 50c. per hour for a through 10-hr. day, but the men demanded an 8-hr. day with extra pay for overtime. The commission thereupon decided on a complete stoppage of work on the Canal, which went into effect on June 21. The number of men affected is 2,200, many of whom have left the neighborhood to seek work elsewhere.

Detroit Calls for Bids on 20-Mile Street Railway Improvement

Detroit's municipal street railway, provided for by the $15,000,000 bond issue passed on April 5, has been launched with the calling for bids on about 20 miles of street railway tracks, including excavating, concrete foundation, ties, rails and all track equipment.

Work has already been started on one line, the Charlevoix-Buchanan crosstown line. The new lines are designed to supply some of the much needed east and west crosstown service, and to relieve traffic in the congested factory districts now inadequately served as well as overcome the necessity for riders going down town to the City Hall to transfer to other parts of the city.

The work and materials will be let under three classes, (1) foundation work which comprises excavating, concrete foundation, tile draining and crushed stone backfilling; (2) oak ties; and (3) steel work, including all the required steel from rails to spikes. T-rails weighing 91 lb. per yard are specified. The main quantities involved are 95,080 cu.yd. of excavation, earth or other material; 115,230 sq.yd. of 8½-in. concrete foundation; 6,665 cu.yd. of ½-in. crushed stone backfill; 55,000 oak ties; and 4,400 tons of steel rails. The municipal work is being done by the Board of Street Railway Commissioners, for which William C. Markham is engineer.

The fact has been brought out that Michigan seems to have no legislation contemplating public ownership of such a utility as the city proposes to construct, and the Michigan Public Utilities Commission has asked the Attorney General for an opinion regarding its powers with regard to the project.

A map of the Charlevoix-Buchanan route has been submitted to the state commission, showing where the new line will cross the Detroit United Railway's lines and the various steam railroad lines. The question of the proper safety devices to be installed has arisen. If the lines in question were being constructed by a private corporation, it is conceded that the commission would have power to decide on what safety devices should be installed at the crossings and to apportion the expense. Ordinarily this would be to require the new line to install the devices at its own expense and divide the maintenance costs equally between the intersecting lines.

It is believed, however, that the law does not provide the commission with power to direct a municipality constructing its own lines to pay the charges that might otherwise be assessed against a private company.

Montreal Water Board Announces New Appointments

The newly created Montreal Water Board, composed of A. E. Doucet, director of Public Works, chairman; Walter J. Francis and R. S. Lea, has made the following appointments to its engineering staff: Charles J. DesBaillets, engineer in charge; F. E. Field, assigned to work in connection with pumping stations and filtration plant extension; F. Y. Dorrance, assigned to work of completion of aqueduct and the several bridges which cross it; M. Tison, A. Jette, A. Leroux, L. O'Sullivan, P. M. Chaussé, W. W. Dickson and N. Belanger, whose duties are divided upon the work assigned to Mr. Field and Mr. Dorrance. All of the staff, with the exception of Messrs. DesBaillets, Tison, O'Sullivan and Chaussé were formerly members of either the aqueduct or filtration works of Montreal.

Safety Engineers Meet in Chicago

At the summer meeting of the engineering section of the National Safety Council, held in Chicago on June 24, the safeguarding of machinery was the main subject of papers and discussions. Particular attention was given to power presses, as the Council has undertaken the preparation of a power press safety code for the American Engineering Standards Committee. A dinner was given jointly by the National Safety Council, the Chicago Safety Council, the Illinois Manufacturers Association and the Western Society of Engineers.

Activities of the A. A. E.

The Phoenix (Ariz.) Chapter was addressed, May 3, by A. L. Harris, who spoke on the Paradise-Verde irrigation project. He recommended that two dams be built, one at the Horseshoe dam site and the other at Camp Verde dam site, both located in Yavapai County, which would add about 93,000 acres of productive land to territory in the vicinity of Phoenix. He said that only 50 per cent of the Verde and

The Albany (N. Y.) Chapter, at a recent meeting, elected the following officers: President, G. P. Graham; vice-presidents, V. L. Ostrander and L. W. Irish; secretary, R. N. Barrett; treasurer, R. E. Hartman.

The Philadelphia Chapter was recently addressed by Gifford Pinchot, Pennsylvania state forester. Mr. Pinchot advocated the restoration of waste lands in Pennsylvania. He stated that one-sixth of the state is a waste from forest fires, keeping out of the pockets of the people not less than $80,000,000 a year. At the present time, he said, the timber produced in the states does not supply the demand, and the yearly freight bill on lumber imported from other parts of the country amounts to $175,000,000.

The Milwaukee Chapter, May 5, elected the following officers for the ensuing year: President, N. Prakken; vice-president, T. R. Minert; directors, H. W. Israel and H. C. Schmidt; treasurer, William Tubesing; secretary, C. S. Gruetzmacher. A call for a meeting to organize a state assembly has been issued to other chapters and clubs in Wisconsin. The state organization is desired to handle the proposed engineers' registration bill and the provision for a state map bureau.

The New York Chapter, at its meeting of May 12, elected the following officers: President, R. H. Jacobs; first vice-president, C. P. Abbott; second vice-president, F. H. Judd; secretary, L. B. Smith; treasurer, E. L. Miller.

The association announces the formation of state assemblies in Washington and Nebraska. Seven chapters of the former, May 22, sent delegates to Tacoma, who elected G. W. Osgood temporary president and W. D. Smith secretary. The next meeting will be Aug. 24 at Everett, where a revision of laws relative to county engineers will be considered. The Nebraska Assembly, May 29, at Lincoln, elected as president, W. R. McKeen, president McKeen Motor Car Co.; vice-presidents, Prof. Clark E. Mickey, University of Nebraska, and Roy N. Toll, city commissioner, Omaha; treasurer, George W. Bates, city engineer, Lincoln; secretary, Watson Townsend, assistant engineer, Union Pacific.

CIVIL SERVICE EXAMINATIONS

United States

Structural Engineer, $1,800 a year. Form 1312. Applications should be filed not later than July 27.

Psychological Investigator in Employment Tests, $3,000 to $3,800 a year. Form 2118. Applications should be filed not later than July 27.

Senior Engineer, Bureau of Valuation, Interstate Commerce Commission, $1,920 to $2,700 per year. Make application before July 20.

Canada

Application forms may be obtained from the office of the Employment Service of Canada, or from the Secretary of the Civil Service Commission, Ottawa, and must be filed not later than July 16.

Shipyard superintendent, Sorel, P. Q., $3,000 to $3,540 a year.

Hydraulic engineer, $2,700 to $3,180 a year.

Junior Hydrometric engineer, $1,680 to $2,040 a year.

Junior engineers, $1,680 to $2,040 a year.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Portland, Ore., Aug. 10-12.

AMERICAN PUBLIC HEALTH ASSOCIATION, Boston; San Francisco, Sept. 13-17.

The Colorado Section, Am. Soc. C. E., at its annual meeting, June 12 elected the following officers: President, Oliver T. Reedy; vice-president, A. N. Miller; secretary-treasurer, John S. Meads.

The Western Society of Engineers, June 21, heard a paper by T. L. Condron on "State Registration of Engineers," which dealt with the present Illinois law and with the proposed uniform law drafted by a committee of Engineering Council. Stress was laid upon the present lack of uniformity by which engineers engaged in interstate practice are confused as to the rights and responsibilities. Evidence of experience and attainments was suggested as even more important than ability to pass an examination. There was some discussion as to land surveyors, it being claimed by S. L. Greeley that the proposed law is unjust to them. Mr. Condron held that surveying is a branch of engineering and does not need special mention.

The Society of Municipal Engineers of Philadelphia, at its meeting June 23, adopted resolutions expressing its desire to co-operate with the experts who are making a survey of the classified service of that city. Resolutions of appreciation were also adopted for Henry H. Quimby, chief engineer, Department of City Transit, on his retirement as president of the society. An election of officers resulted as follows: President, Frank E. Maize; vice-presidents, Charles Frommer, James S. Shute and Seth M. VanLoan; secretary, Charles H. Stevens; treasurer, William J. Logan.

The Nashville (Tenn.) Engineering Association, through a committee of which Hunter McDonald is chairman, is working to raise an endowment fund of $500,000 for the engineering department of Vanderbilt University. The association is also endeavoring to secure $10,000 immediately for the purchase of machinery to be used in the instruction of engineering students. The committee feels that this amount should be raised at once, since the government is selling engineering machinery on hand for 15 per cent less than cost, and pieces from that lot could be used to great advantage in the engineering department of the university. The association will bring the proposition for an endowment fund before the various civic and business organizations of Nashville, in the hope that the city will contribute at least $200,000, leaving $300,000 to be secured from outside sources.

PERSONAL NOTES

LIEUTENANT-COLONEL EDWARD BARTOW, chief, Illinois State Water Survey, has resigned to accept a position as head of the department of chemistry, State University of Iowa. While in France, Colonel Bartow was in charge of water analysis laboratories for more than two years. For several years he was secretary of the Illinois Water Supply Association, which eventually was absorbed as a section of the American Water Works Association.

ALBERT H. JEWELL, principal assistant engineer, Michigan State Board of Health, will succeed Charles A. Haskins, whose resignation is noted elsewhere in these columns, as chief engineer of the Kansas State Board of Health. He served during the war as lieutenant in the Sanitary Corps at Camp Custer, Mich., for a few months and later as water supply officer with one of the Engineering Regiments in France. Previously, he was chemist at the Toledo filtration plant.

C. C. WESTFALL is engineer of bridges of the Illinois Central R.R., and not C. I. Anderson, as was stated last week. The information concerninf the appointment we now learn was erroneous.

ARTHUR F. BARNES, formerly dean of engineering, New Mexico State College, has become associated with Barglebaugh & Whitson, architects and consulting engineers, of Dallas, El Paso and Houston, Tex., as mechanical and industrial engineer and manager of their New Mexico-Arizona district.

J. RALPH VAN DUYNE has has been appointed chief engineer of construction of the Passaic Valley (N. J.) Sewerage Commissioners, succeeding the late William M. Brown. Mr. Van Duyne was deputy engineer at a salary of $6,000. The new appointment carries with it an increase of $1,500.

L. L. ROGERS has severed his connection as field engineer of the Lakewood Engineering Co.'s paving department. Previous to his service in that company, he was a member of Roger Brothers Construction Co., highway engineers, Los Angeles, and he is now returning to California to re-enter the road constructing field, rejoining Roger Brothers, with headquarters at Los Angeles.

LIEUT.-COL. EDWARD M. STAYTON has been made city representative on the Board of Control of Kansas City (Mo.) Railways, of which Philip J. Kealy is the other member. He replaces R. P. Woods, who recently resigned to devote his time to the Kansas City, Clay County & St. Joseph Ry., of which he is vice-president and general manager. Colonel Stayton entered the army, shortly after returning from service on the Mexican Border, as major of the 110th Engineers, and was later made lieutenant-colonel. Since his return from France, he has been consulting engineer for the location and construction of highways in Clay and other counties in Missouri. He will assume his new duties about Aug. 15.

CHARLES A. HASKINS, chief engineer and director of the Water and Sewage Laboratories, Kansas State Board of Health, has resigned to associate himself with Black & Veatch, consulting engineers, Kansas City, Mo. His resignation will become effective about July 1. Mr. Haskins has been connected with the Kansas State Board of Health for nine years, with the exception of a leave of absence in 1915, spent with the United States Public Health Service in the investigation of the pollution of coastal waters. He served during the war as a captain in the Sanitary Corps, detailed to the office of the surgeon-general on special investigations of water and sewage problems.

HAMILTON & BARBER is the name of the new firm, established by Peter D. G. Hamilton and George H. Barber, civil engineers, which will specialize in designs, details and plans for structural steel and ornamental iron work. The firm's offices are at 50 Bromfield St., Boston.

P. W. ELMORE, assistant engineer, Indiana Division, Baltimore & Ohio R.R., has been made assistant division engineer, with headquarters at Toledo; J. W. PURDY, assistant engineer, Ohio Division, has been made assistant division engineer, with headquarters at

Chillicothe, Ohio, and MARK H. BEARD has been made assistant division engineer, Cleveland Division, with headquarters at Cleveland.

L. H. BOND, assistant engineer, Illinois Central R.R., has been appointed district engineer of the Northern lines, with headquarters at Chicago.

J. H. SYDENSTRICKER has been appointed road engineer of Monroe County, W. Va.

ALBERT L. UPHAM has resigned as field engineer with Stone & Webster at Hartford, Conn., and is now located at New Britain, Conn., representing Brown & von Beren, architects, of New Haven, during the construction of a building for the Besse-Leland Co.

P. H. CASSIDY has resigned as superintendent of construction of bridges, power plants and substations for the Eastern Pennsylvania Railway, Light, Heat & Power Co., of Pottsville, Pa.

C. V. SWEET and L. V. TEESDALE, of the U. S. Forest Products Laboratory, Madison, Wis., have resigned to enter the forest service of the Government of India, their special duty being to investigate commercial methods of seasoning timber.

E. E. CHADWICK, recently assistant engineer on filter design and construction, Minneapolis water department, has been elected city engineer of Winona, Minn. He succeeds Henry E. Wolff.

H. G. PERRING, consulting engineer, and engineer to the Board of Commissioners of Public Grounds and Buildings of Pennsylvania, has been appointed chief engineer of Baltimore, Md. He will have charge of the engineering details of the water-front development and general improvement plans for Greater Baltimore, for which work loans have been authorized. He will receive an annual salary of $7,000.

MAJOR HARRY D. WILLIAR, JR., who served in Europe with the First Engineers, First U. S. Division, has resigned as district engineer in charge of the Washington office of the Asphalt Association. He has been appointed assistant chief engineer of the Maryland State Roads Commission.

OLDER & QUINLAN, consulting engineers, Monadnock Block, Chicago, have merged their engineering practice with the practice of Arthur W. Consoer, under the corporate name of the Consoer Engineering Co. Clifford Older is president of the company, George A. Quinlan, secretary and treasurer, and Mr. Consoer vice-president and business manager. The company will conduct a general engineering business at the above address, Mr. Older and Mr. Quinlan continuing their consulting practice.

F. A. DANFORTH, topographic engineer, U. S. Geological Survey, has completed the survey of the Salt Lake quadrangle, Texas, and the control of the Fort Stockton and Free quadrangles, Texas. He will sail for Hawaii, July 10. A. O. BURKLAND, topographic engineer in charge, and R. M. WILSON, assistant topographer, left June 5 for Honolulu to begin the co-operative topographic survey of Hawaii.

CHARLES E. PARRY, formerly principal assistant city engineer of Allentown, Pa., is now located in Philadelphia as designing and construction engineer for the Municipal Disposal Co.

FRED BROWN, until recently engineer of the Hastings (Mich.) Table Co., has been appointed city engineer of Muskegon, Mich.

O. D. CHRISMAN has resigned as city engineer of Springfield, Mo., to open a civil engineering office in that city. G. W. Culler, of the city engineering department, will succeed Mr. Chrisman.

CHRISTOPHER J. SHERIDAN, recently assistant city engineer, has been appointed deputy city engineer of Yonkers, N. Y. He succeeds the late George L. Christian.

H. F. JOHNSON has resigned as resident engineer of the Wyoming State Highway Department to become office engineer of the Midland Bridge Co., at Kansas City, Mo.

COPE, RAND, MEANS CO. is the name of a new engineering firm established by T. H. Means, irrigation engineer, and E. L. Cope, consulting engineer, both of San Francisco. Lieutenant-Colonel L. H. Rand, Corps of Engineers, U. S. Army, formerly at San Francisco and recently transferred to Camp Dodge, Iowa, also has an interest in the firm. The firm will specialize in hydraulic and structural engineering, with offices in the Holbrook Building, San Francisco.

W. J. SWEGMAN, superintendent and mechanical engineer of the Wabash Portland Cement Co., has joined the staff of J. C. Buckbee Co., engineers, Chicago.

A. F. HEINZE has become the manager of the newly organized American Professions Supply Co., 58 W. Washington St., Chicago.

J. L. PIFER & CO., civil, mining and municipal engineers, Herrin, Ill., has gone out of business and sold its equipment to Pfeiffer & Mallams, consulting engineers, of that city. Mr. Pifer has accepted a position in Tacoma, Wash.

EDWARD A. ROTH, formerly concrete engineer for E. I. Du Pont de Nemours Co., at Wilmington, Del., has opened architectural and engineering offices in the Drexel Building, Philadelphia.

THOMAS L. WILLIS has tendered his resignation as city engineer of New Orleans, La., on account of ill health. He will be succeeded by W. Beauregard Davey, chief engineer of the Orleans Parish Levee Board.

S. J. CHAPLEAU, civil engineer, Ottawa, has been appointed to act as representative for Canada on the Board of Control, the formation of which was recommended by the International Joint Commission for the construction of compensating works in St. Mary River by the Michigan Northern Power Corporation and the Algoma Steel Corporation.

OBITUARY

MATTHEW GAULT, superintendent of the Sewer Department, Worcester, Mass., died in that city June 26. He was 53 years of age, and a graduate of Dartmouth, 1890. He entered the employ of the city of Worcester under F. F. McClure, city engineer. For many years previous to 1907 he was the assistant engineer in charge of sewer work. In 1907 he succeeded H. P. Eddy as superintendent of sewers. From 1911 to 1913 the experimental work on behalf of Imhoff tanks and trickling filters was under his direction, as well as the recent activated sludge experiments.

BUSINESS NOTES

THE CONNEAUT SHOVEL CO., Conneaut, Ohio, has acquired additional land immediately west of its plant at Conneaut, on which a new rolling mill will be built.

THE BRIGGS CO., Lansing and Flint, Mich., announce the opening of another branch office at 43 Pearl St., Grand Rapids, in charge of L. B. Wood.

THE NATIONAL ENGINEERING SERVICE CORPORATION, W. K. Palmer, president, announces the opening of an Eastern office at 30 Church St., New York City, in addition to its Kansas City and Chicago offices. J. F. Kaufman, special engineer of the corporation, from the operations office at Kansas City, is now in charge of the New York office, at the same time directing industrial work which the corporation has in hand at Newark, N. J.

THE WATSON-STILLMAN CO., New York City, announces the following changes in personnel, owing to the retirement from active interest in the management of A. F. Stillman: E. A. Stillman remains as president, with supervision of sales; Carl Wigtel, chief engineer, has been elected vice-president; J. D. Brocks, treasurer; A. Parker Nevin, secretary; LeRoy T. Brown appointed works manager; J. W. Delano, assistant works manager and W. H. Martin purchasing agent. The offices of general manager and superintendent are discontinued and G. D. Kershaw and J. F. Lary are no longer connected with the company.